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DSIR

DSIR Information Series No. 145

DSIR RESEARCH DIRECTORY

Compiled by the Science Information Division

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DSIR Information Series No. 145

DSIR RESEARCH DIRECTORY

Review of organisation and activities in the Department of Scientific and Industrial Research and Research Associations

Compiled by the Science Information Division

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HEAD OFFICE

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DIRECTOR-GENERAL: E. I. ROBERTSON, OBE, MSc *NZ*,
PhD *Lond*, DIC, FRSNZ

ASSISTANT DIRECTOR-GENERAL: G. W. Butler, MSc, FilDr *Lund*, FRSNZ

Assisted by: D. C. Isaacs, BAgrSc
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ASSISTANT DIRECTOR-GENERAL: D. Kear, BScEng, BSc, PhD, *Lond*, ARSM, FRSNZ, MAIMM

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ASSISTANT DIRECTOR-GENERAL: A. J. Ellis, MSc, PhD, FRSNZ, FNZIC

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Geothermal Co-ordinator: D. Kear, BScEng, BSc, PhD *Lond*, ARSM, FRSNZ, MAIMM
International Science and Aid Co-ordination: W. R. Dale, BSc, DipAgrSci

Director of Administration: J. Gould
Accountant: J. H. Rees, ACA
Minister (Scientific), London: R. W. Foster, CEng, MIMechE, MNZIE

The Director-General, as Permanent Head of the Department is directly responsible to the Minister of Science and Technology for implementing Government policy affecting DSIR, including assessment of research priorities, which is reflected in the provision of facilities, staff, and finance to branches. He is also an *ex officio* member of the National Research Advisory Council, established in 1963 to advise the Minister on co-ordination of the national scientific effort and selection and management of scientific programmes.

The three Assistant Directors-General advise the Director-General on specific fields of application of science and are responsible for appropriate groups of branches. Dr Butler is broadly responsible for agriculture and biology, human health, and the social sciences; Dr Kear is responsible for earth sciences, oceanography, minerals, and energy resources; Dr Ellis is responsible for agricultural processing, forest products, and manufacturing, building and construction, transport and communications, and other scientific services.

The Director/Superintendent of any branch plans his programme of research to implement Department policy within the resources of staff and money allocated to him. In the use of expensive equipment there is a considerable amount of collaboration between branches and between the Department and universities.

The Director of Administration organises the administrative and clerical service of Head Office and advises branches on administrative staff, and clerical procedures.

Management aspects of the organisation of the Department are subdivided into science budget, Dr Robertson; personnel, Dr Butler; overseas liaison and technical assistance, Dr Kear; and buildings, large items of equipment, and computers, Dr Ellis.

Through a continuing involvement with the work of the N.Z. Energy Research and Development Committee, the Geothermal Unit has become the focal point within DSIR for energy matters and co-ordinates the work of the several Divisions engaged in the field of geothermal energy research.

The Department maintains an officer on the staff of the New Zealand High Commission in London. The Minister (Scientific), seconded from DSIR, has a wide role in relation to New Zealand's scientific effort. This involves liaison on behalf of many New Zealand organisations, including Government departments, universities, and the manufacturing and commercial sectors; facilitating the exchange of scientific information; and assistance with visits of scientists between New Zealand, the United Kingdom, and other countries. The Office interviews applicants for scientific posts in New Zealand advertised in the United Kingdom and sends to appropriate employers information about scientists interested in employment in New Zealand.

DIRECTORY

LOCATION OF RESEARCH STATIONS

The main DSIR branches are clustered in the Auckland, Palmerston North, Lower Hutt-Wellington, and Lincoln-Christchurch areas.

Auckland: Auckland Industrial Development Division, Entomology Division, Plant Diseases Division, and substations and district offices of several other Divisions.

Palmerston North: Applied Biochemistry Division, Grasslands Division, Plant Physiology Division; the Dairy Research Institute and the Leather and Shoe Research Association; and substations and district offices of other Divisions.

Lower Hutt-Wellington: Head Office, Applied Mathematics Division, Chemistry Division, Ecology Division, Geological Survey, Geophysics Division, Industrial Processing Division, Institute of Nuclear Sciences, Oceanographic Institute, Physics and Engineering Laboratory, Soil Bureau, Science Information Division, and most of the Research Associations.

Lincoln-Christchurch: Antarctic Division, Botany Division, Christchurch Industrial Development Division, Crop Research Division, the Wheat Research Institute, the Wool Research Organisation, and substations and district offices of other Divisions.

In addition to the main centres, most of the Divisions concerned with biological research have substations at which work related to particular environments is done, for example Grasslands Division has the most northerly substation within New Zealand (Kaikohe) and, with Crop Research Division, the most southerly one (Gore). Ecology Division has a freshwater substation at Taupo, and Plant Diseases Division has research orchards at Te Puke, Havelock North, Appleby, and Earnscleugh. There is also a small, regional research station at Riwaka.

Divisions such as Geological Survey and Soil Bureau have district offices in several parts of New Zealand, and Physics and Engineering Laboratory maintains its auroral station at Lauder.

A liaison officer is stationed at the New Zealand High Commission in London.

In the Pacific, DSIR has a Plant Diseases Division research station on Rarotonga and observatories at Apia (Western Samoa), Rarotonga, Raoul Island, and Campbell Island.

In Antarctica, DSIR maintains a main base (Scott Base), Vanda Station, and a summer station at Cape Bird.

SITE CONDITIONS AT THE MAIN CENTRES FOR BIOLOGICAL RESEARCH

MOUNT ALBERT RESEARCH CENTRE, AUCKLAND

Lat: 36° 54′ S. Long: 174° 44′ E. Alt: (climatological station): 41 m.
Soil type: Basalt from volcanic cone of Mount Albert, overlying argillaceous sandstone; where sandstone is exposed the soil is podzolised.
Rainfall: Average 1356 mm per annum on 143 days, almost evenly distributed throughout the year, greatest from May to August and least from November to March.
Temperature: Mean maximum 19° C; mean minimum 11°; mean 14.5° C. Days with ground frost 17.
Hours of sunshine: 2102 (Albert Park).

PALMERSTON NORTH RESEARCH DIVISIONS

Lat: 40° 23′ S. Long: 175° 37′ E. Alt: 32 m.
Soil type: Manawatu silt loam.
Rainfall: Average 995 mm per annum on 180 days, distribution even, occasional late summer drought. Mean evaporation 787 mm.
Temperature: Mean maximum 16.6° C; mean minimum 8.3° C. Days with ground frost: 66.
Hours of sunshine: 1800.

SOIL BUREAU, LOWER HUTT

Lat: 41° 11′ S. Long: 174° 48′ E. Alt: 27.5-229 m.
Soil type: Taita hill soils from strongly weathered greywacke, and Wingate soils from loessial drift.
Rainfall: 1316 mm per annum on 163 days: distribution even with slight winter peak.
Temperature: Mean maximum 16.3° C; mean minimum 8.6° C. Days with ground frost: 29.
Hours of sunshine: 1789.

RIWAKA RESEARCH STATION

Lat: 41° 6′ S. Long: 172° 58′ E. Alt: 8 m.
Soil Type: Riwaka silt loam.
Rainfall: 1372 mm per annum on 101 days; well distributed, but slightly heavier in winter months.
Temperature: Mean maximum 18.0° C; mean minimum 6.8° C; mean 12.3° C. Days with ground frost: 80.
Hours of sunshine: 2485.

LINCOLN RESEARCH DIVISIONS

Lat: 43° 38′ S. Long: 172° 48′ E.
Soil type: Alluvial silt loams.
Rainfall: 635 mm per annum on 125 days; distribution erratic, late spring droughts common. Mean evaporation (4 years) 955 mm per annum.
Temperature: Mean maximum 16.1° C; mean minimum 6.8° C; mean 11.6° C. Days with ground frost: 93.
Hours of sunshine: 2041.

DSIR SCIENTIFIC COLLECTIONS

The following scientific collections are held and maintained for research and reference by DSIR Divisions and grant-aided Research Associations.

BOTANICAL

General herbarium	Botany Division, Lincoln Ecology Division, Lower Hutt
Herbage Species Herbarium	Grasslands Division, Palmerston North
Fungal Herbarium	Plant Diseases Division, Mount Albert, Auckland
Seed Collections	Grasslands Division, Palmerston North Crop Research Division, Lincoln Riwaka Research Station

INVERTEBRATES

Marine Invertebrates, Marine Benthos, Marine Plankton	Oceanographic Institute, Wellington
N.Z. Arthropod Fauna (non-marine, mainly insects)	Entomology Division, Mount Albert, Auckland
Freshwater Invertebrates	Ecology Division, Lower Hutt
Nematodes (National Nematode Collection)	Entomology Division, Mount Albert, Auckland
Insects	Ecology Division, Lower Hutt

VERTEBRATES

Rabbits, Hares, Rodents, Mustelids, and Wallabies	Ecology Division, Lower Hutt
Amphibians and Reptiles	Ecology Division, Lower Hutt

MICRO-ORGANISMS

N.Z. Reference Culture Collection of Micro-organisms	N.Z. Dairy Research Institute, Palmerston North
Soil, Plant, and Industrial Pathogens	Plant Diseases Division, Mount Albert, Auckland
Dairy Organisms and Phages	N.Z. Dairy Research Institute, Palmerston North
Meat Poisoning and Spoilage Organisms	Meat Industry Research Institute of N.Z. (Inc.)
Rumen Micro-organisms	Applied Biochemistry Division, Palmerston North
Rhizobium Strains	Applied Biochemistry Division, Palmerston North Plant Diseases Division, Mount Albert, Auckland

GEOLOGICAL AND SOIL

Petrological (a) Minerals (b) Rocks and thin sections	Geological Survey, Lower Hutt
Paleontological (a) Macrofossil (b) Microfossil (c) Palynological	Geological Survey, Lower Hutt
Core samples	Geological Survey, Lower Hutt
Soil Monoliths	Soil Bureau, Taita
Marine Surface Sediment Samples	Oceanographic Institute, Wellington
Marine Deep Water Sediment Cores	Oceanographic Institute, Wellington

ANTARCTIC DIVISION

Union Centre Building, 214A Oxford Terrace, Christchurch
POSTAL ADDRESS: P.O. Box 13247, Armagh, Christchurch
TELEGRAMS: ANTARCTIC Christchurch TELEX: New Zealand 4432
TELEPHONE: 791 540 Christchurch

SUPERINTENDENT: R. B. Thomson, OBE

Antarctic Division was established in May 1959 to implement New Zealand's scientific programme in the Antarctic. The Division's role has expanded in recent years to include not only implementation of government scientific policy but also advice and assistance in the formulation of policy governing all non-scientific activities. These include environmental controls, such as measures to protect Antarctic flora and fauna, the control of tourism, and other legal and jurisdictional matters that may arise. To carry out New Zealand's many responsibilities under the Antarctic Treaty, the Division undertakes research from time to time, in specialised fields such as monitoring the effects of man's activities on the environment and population studies of various fauna particularly where human interference is a known factor. The Division also maintains an information centre on Antarctic research and exploration and provides regular exchanges of information as required under the Antarctic Treaty. The Division's permanent strength in Christchurch is 23. An additional 35 temporary staff are employed for service in Antarctica during peak summer activity. A total of 166 (including worker visitors and university expeditions) were involved in the 1978–79 New Zealand Antarctic Research Programme.

Bases

New Zealand has one main base in Antarctica (Scott Base) which is located on Ross Island. Scott Base and the nearby "quiet site" of Arrival Heights combine as one to form part of a world network of stations at which a continuous observatory programme in the upper atmosphere and earth sciences is maintained, with particular emphasis on observations of global significance. A staff of up to 13 are stationed at Scott Base during the winter months to support and implement the scientific programme. Base population during the summer season often increases to near 60 with the arrival of summer maintenance personnel, worker visitors and transitory field parties. This increasing population situation has necessitated a phased rebuilding programme which was commenced in 1976. Construction of the new power house was completed and power and heat generation commenced toward the end of the 1978–79 summer season. The total reconstruction programme is expected to take some years to complete.

Vanda Station, 130 km to the north-west of Scott Base, is New Zealand's only base on the Antarctic continent proper. Although parties have wintered there in the past, Vanda is currently operated during the summer months only. Its main function is to support field activities in the Dry Valley Region generally; but, in addition, Vanda serves as a centre for local meteorological, hydrological, and glaciological studies of the Wright Valley itself, which contributes to a greater understanding of the climatic peculiarities of the Dry Valley Region as a whole.

Cape Bird, situated 100 km north of Scott Base on the northern tip of Ross Island, serves as a base for biological field parties who conduct annual projects there in terrestrial and marine biology.

Field activities

Biological field parties operate from Scott Base, Cape Bird, and White Island during the summer months. Although long-term studies of the population and behavioural patterns of penguins and seals continue, recent years have seen an increase in marine biological work. This year's programme includes physiological and vision studies of selected polar fishes and invertebrates, with particular emphasis on oxygen transport and nervous excitability in Antarctic poikilotherms.

Psychological studies to determine the sensory and cognitive changes that may arise in winter-over personnel during their isolation are also taking place.

There are a wide variety of geological projects each year. Soil studies in the Dry Valley region and detailed geological mapping both of the area between the Koettlitz and Blue Glaciers and also in the coastal ranges of Marie Byrd Land have been carried out. Following the proposed 1979–80 geological mapping in the Blue Glacier region, steps are being taken to initiate compilation of regional geological maps at scale of 1:250 000 or 1:100 000 between the Skelton and Taylor Valleys. This work is being supported partly by the Antarctic LANDSAT cartographic programme, commenced in 1978. Gravity studies are continuing of the Taylor Valley to determine its geological structure and past history. Research programmes are also being carried out involving glaciology and hydrological studies incorporating glacier margin surveys in the Wright Valley, phototheodolite studies of selected glaciers, and both regional and detailed studies of strain in the McMurdo Ice Shelf.

International projects

New Zealand scientists are actively involved in several long-term projects in close co-operation with other nations. One of the most notable was the Dry Valley Drilling Project which was completed in 1976. New Zealand is also one of the participant nations in the Ross Ice Shelf Project, begun in 1974, to study the physical, chemical, biological, and geological conditions in and beneath the Ross Ice Shelf. Since 1972, New Zealand, American, and French scientists have been involved in volcanological studies on Mt Erebus, one of only two volcanoes in the world with an active laval lake. Other important scientific programmes have involved West German and Japanese scientists working in conjunction with the New Zealand programme. The summer season, 1978–79 saw New Zealand scientists participating in a major international project in the Darwin Mountain region and similar projects are being planned for the Elsworth Mountains and Northern Victoria Land. The Northern Victoria Land Expedition at present consists of 16 New Zealand research projects, including proposed compilation of a regional satellite photomosaic map at a scale of 1:100 000.

Logistic support

New Zealand and the United States continue to co-operate fully in providing logistic support for their respective programmes. This past season, Australia also contributed to the logistics flight pool and is likely to continue as a partner in the programme.

APPLIED BIOCHEMISTRY DIVISION

Fitzherbert West, Palmerston North
POSTAL ADDRESS: Private Bag, Palmerston North
TELEGRAMS: BIOCHEM Palmerston North TELEPHONE: 68 019 Palmerston North

DIRECTOR: R. W. Bailey, MSc, PhD *Birm,* DSc *Birm,* FRSMZ
DEPUTY DIRECTOR: C. S. W. Reid, MSc, PhD *Cantab,* FRSNZ

Biochemistry and Microbiology: R. T. J. Clarke, MSc, PhD *Massey*
Organic Chemistry: G. B. Russell, BSc (Hons), PhD *Cantuar*
Plant Chemistry and Physiology: P. F. Reay, BSc (Hons), PhD *Cantuar*
Animal Nutrition and Physiology: M. J. Ulyatt, MAgrSc, PhD *Massey*
Services: K. I. Williamson, MSc *NZ*

SUBSTATION

LINCOLN LABORATORY, c/- Crop Research Division, J. D. Ferguson, BSc (Hons), PhD *Wales*

STAFF: 47 scientists, 45 science technicians, and 12 supporting staff.

Applied Biochemistry is concerned with the nutritional evaluation and acceptability of forages and human foodstuffs, and with some aspects of grassland and crop productivity, including photosynthesis and symbiotic nitrogen fixation. The core disciplines are biochemistry and nutrition, with supporting disciplines in ruminant physiology, microbiology, and the chemistry of natural products.

Current projects

Mineral nutrition of plants and animals: nutrition and cycling of trace elements; chemical binding and availability of minerals in forages and foodstuffs.

Protein and nucleic acid biosynthesis: studies of regulation of protein and RNA synthesis in plant tissue.

Cellular development: changes in cells during differentation; membrane biogenesis in legume nodules; characterisation of enzyme systems associated with nodule development and function.

Nitrogen fixation: biochemical, microbiological, and ultrastructural studies of symbiotic nitrogen fixation in legume root nodules; classification of rhizobial strains; studies on rhizobium phages and antibiotic resistance.

Plant carbohydrates: changes in composition of plant cell walls during development; utilisation of sawdust and bark waste; investigations in fibre content and retting of linen flax.

Protein nutrition: investigation of alternative protein sources for livestock feeds and human foods (leaf protein concentrate, sweet lupin seed and non-toxic rape seed meals); evaluation of nutritive quality of food and forage proteins.

Unusual plant constituents: plant phenolics especially tannins, saponins, cyanoglucosides, and glucosinolates; oestrogenic substances in pastures; insect hormones and toxins in native plants; insect anti-feeding substances in plants; toxic compounds from pasture fungi.

Microbiology: microbiology of digestive tracts of ruminants, opossums, and insects; scanning electron microscope studies of rumen wall and bacteria; microbial degradation of wastes and generation of methane.

Ruminant nutrition and metabolism: nutritive value of pasture plant strains; digestion and absorption of feed components in various regions of the ruminant gut; computer simulation of rumen digestive activities.

Digestive physiology: investigations of ruminant digestive system employing radiological, electronic, and chemical techniques; ruminant digestive and metabolic disorders (bloat, grass staggers, ryegrass staggers); excess fat in sheep.

Lipids: lipid composition of ruminants, rhizobia, and seeds; metabolism of dietary lipids in the ruminant; control of fat deposition in the ruminant.

Flavour: identification of mutton flavour components; investigation of effect, of diet on flavour; gas chromatograph—mass spectrometer analysis of flavours.

Crop biochemistry: plant-insect relationships, including resistance to aphids, grass grub, and porina; abscisic acid effects on crop plants; agronomic and physiological factors affecting lupin seed yields; methods for screening plant populations for chemical characteristics; physiology of vegetable crops in relation to storage and processing.

Future developments

The Division, often in collaboration with other organisations, will continue to concentrate mainly on aspects of New Zealand's primary industries, particularly innovative developments. Current projects in the initital stages of development include: microbial and enzymic conversion of agricultural wastes to energy, overfatness in sheep and lambs, utilisation of novel legumes, and the effects of secondary metabolites in plants used as animal feeds. Longer-term projects will evolve around the production of data on the nutritional composition of New Zealand foodstuffs and the investigation of enzymic and other aspects of crop processing.

APPLIED MATHEMATICS DIVISION

7th Floor, Rankine Brown Building, Victoria University of Wellington
POSTAL ADDRESS: P.O. Box 1335, Wellington
TELEGRAMS: RESEARCH Wellington
TELEPHONE: 727 855 Wellington

DIRECTOR: H. R. Thompson, PhD *Manch*
Mathematical Statistics: R. B. Davies, PhD *Cal*
Mathematical Physics: A. McNabb, BA *Cantab,* DSc *Well*
Operational Research: H. Barr, PhD *Toronto*
Computing: B. K. Campbell, BSc
Library: R. Dickinson, BA, Dip NZLS

SUBSTATIONS:

AUCKLAND: c/- Mt Albert Research Centre. J. H. Maindonald, MSc
PALMERSTON NORTH: c/- Grasslands Division. V. J. Thomas, BA, PhD *Massey*
TAITA: c/- Soil Bureau. D. A. Rhoades, PhD *Minn*
LINCOLN: c/- Crop Research Division. E. Stevenson, BSc

STAFF: 39 scientists, 2 science technicians, and 12 supporting staff.

Functions

Mathematical service work and projects for DSIR divisions, research associations, Government departments, business, industry, statutory organisations, local bodies, universities, and institutes. Research in those branches of applied mathematics that further the above work.

Current activities

Sociological and economic: analysis of court procedures involved in suing for civil debt; survey of operation of maintenance laws by Magistrates' Courts; survey of apprenticeship training in engineering and carpentry; survey of truancy; house valuations; allocation of Fire Service resources; assessment of factors in car-insurance claims; futures studies.

Agricultural and biological: erosion in clays; modelling of leaf growth and transfer of material through leaves; diffusion models for dispersal of insects; models for toxicity of insect sprays; population ecology studies; design and analysis of soil, fertiliser, crop and grassland trials; enzyme kinetics models.

Industrial (including processing): quality control of export meat cuts and forest products; optimum size and configuration of freezing works facilities; spreading the seasonal meat kill; production scheduling; design and analysis of taste-testing trials.

Transport: transport savings in recycling operations; plant location and distribution problems; analysis of trends in public transport; analysis of container terminal flows.

Natural resources, energy: computerisation of fossil records; estimation of size of mineral deposits; classification and analysis of sediments; mathematics of ore formation processes (e.g. porphyry copper);

reduction of ironsands; flows and stresses in natural gas pipelines; energy supply and demand modelling; design of experiments for methanol use in vehicles; geothermal studies: analysis of natural state of fields and responses to production; reinjection; carbon dioxide and corrosion problems; flows in fractured porous media.

Building and construction: ready-mix concrete studies, including standards; development of probabilistic design code for engineering structures; stochastic models for earthquake loading; design and analysis of tests on building materials.

Miscellaneous: analysis of public library statistics; DSIR Central Library serials acquisition information system; quality control checks on bulk water supply meters; mathematical models in volcanology; computerised bibliography of freshwater research; provision of statistical and computing advice and assistance.

Research and development: numerical matrix methods and large-scale linear and non-linear programming systems; numerical methods in solution of differential equations; significance tests for dependent data; optimal methods of statistical inference; inference from point processes; optimal experimental designs; study of bias in least squares estimation; computer communications; microprocessor software; computer performance analysis, clustering techniques in data reduction; analysis of large-scale statistical packages, particularly GENSTAT.

AUCKLAND INDUSTRIAL DEVELOPMENT DIVISION

Chandris House, 9–11 Albert Street, Auckland 1
POSTAL ADDRESS: P.O. Box 2225, Auckland
TELEGRAMS: AIDEL Auckland
TELEPHONE: 34 116 Auckland

DIRECTOR: W. R. Beasley, CEng. MIMechE
Applied Heat and Physics: G. A. Palmer, MSc
Electronics: J. B. Cornwall, CEng, MIEE
Engineering Design and Product Development: B. H. Hodder, CEng, MIMechE
Engineering Materials: N. A. Miller, BE, PhD, AOSM
Extension Services—Liaison and Information: F. Puch, CEng, MIMechE
Library: C. D. Ralph, NZLACert
Photography: M. J. Lankow
Manufacturing and Management: J. B. Meikle, BE, PhD
Vibration, Acoustics and Stress Analysis: M. C. Smith, BSc, BE, PhD

STAFF: 30 scientists, 36 science technicians, and 12 supporting staff.

The objectives of the Division are to carry out applied research for the manufacturing and processing industries and to provide them with a scientific service in the general disciplines of: electronics; mechanical and manufacturing engineering; metallurgy; physics and applied heat; medical and biological engineering.

Each section has a balanced programme of applied research, short-term investigations, and servicing. The Division disseminates information by direct assistance to industry; production and distribution of reports, pamphlets and articles; and liaison activities, e.g., lectures, seminars, and conferences.

Current projects

Agriculture: instrumentation to detect multiple pregnancies in sheep; measuring fat thickness of live sheep and carcasses; effect of storage and transport conditions on kiwifruit, maize, onions, nectarines, and other fruit and vegetables; designing and testing commercial storage facilities for produce; performance testing of maize-, garlic-, and onion-drying installations.

Building and construction: investigating quality-control methods for pre-painted building materials; assessing structural properties of roof, ceiling, wall, and floor sections; advising on corrosion prevention in cladding, roofing, and other building components; advice on welding of structural components.

Human health: developing—apparatus for automatic epidural injections at set intervals; apparatus for urine-flow measurement, and a portable haemoglobinometer; measuring and assessing environmental noise; evaluation of stress in teeth to determine reasons for restoration failures.

Manufacturing industry: materials—measuring physical and mechanical properties of plastics, rubber and synthetic engineering materials; failure investigations; help with materials selection; advice on corrosion problems; and various projects for the metal-finishing industry on effluent treatment and other problems.

Manufacturing industry: processes and design methods—advisory services for metal cutting and metal forming including cutting tool research; product and process design evaluation; value engineering; materials handling; electrical and electronic consultation; advice on heat treatment; work for the diecasting industry on instrumentation and control; advice on and long-term investigations into topics related to welding; assistance with metallurgically related process problems; finite-element engineering design; local design of heavy truck chassis; development of formation meter for paper industry.

Manufacturing industry: management—production and stock control; quality control in manufacturing, and design of systems for quality assurance; servicing for the New Zealand Organisation for Quality Assurance; economic analysis of production, especially machining and die-casting; plant layout and group technology.

Manufacturing industry: measurement and testing facilities—calibration facilities for temperature, humidity and air flow; electrical calibration; calibration of noise and vibration measuring and recording instruments; engineering-metrology services encompassing measurement of components, tooling and gauges; calibration of measuring instruments; alignment and calibration of machine tools and measuring systems; measurement of load or force, strain, displacement and vibration; calibration of torque-testing meters and pressure gauges; fatigue tests on components; pressure testing components (up to 40 000 psi or 275 MPa); facilities for mechanical testing, metallography and chemical analysis; assessing performance and efficiency of compressors, motors and rotating machinery.

Most of the above are part of the Division's TELARC registrations in chemical, electrical, mechanical, and physical testing and metrology.

Natural resources and environment: developing theory of geothermal fields; monitoring environmental noise.

BOTANY DIVISION

Lincoln
POSTAL ADDRESS: Private Bag, Christchurch
TELEGRAMS: BOTANY Christchurch TELEPHONE: 8019 Halswell

DIRECTOR: E. J. Godley, MSc, PhD *Cantab*, Hon FLS, FRSNZ
ASSISTANT DIRECTOR: H. E. Connor, MSc, DSc

Ecology and Vegetation Surveys: P. Wardle, MSc, PhD *Cantab*, FRSNZ
Palynology and Anatomy: N. T. Moar, MSc, PhD *Cantab*, FLS
Taxonomy: H. E. Connor, MSc, DSc

SUBSTATIONS

AUCKLAND: c/- Mount Albert Research Centre, A. E. Esler, MAgrSc
TAITA: c/- Soil Bureau. A. P. Druce, BE
NELSON: DSIR, Private Bag, Nelson, G. N. Park, MSc, PhD *ANU*
DUNEDIN: P.O. Box 5306, Dunedin, P. N. Johnson, BSc, PhD *Otago*

STAFF: 26 scientists, 17 science technicians, and 8 supporting staff.

The main function of the Division is to study the plants in New Zealand and to describe and classify the native, naturalised, adventive, and horticultural elements of the flora. The description of vegetation, old or new, past or present ranks as a coequal objective. Correlated research is also carried out in genetics, cytology, anatomy, morphology, palynology, and ecology.

To help achieve these major aims the Division houses the largest herbarium in the country and one of the better botanical libraries in Australasia. The Herbarium (International Code CHR, Keeper: Dr D. R. Given) contains about 320 000 specimens of seaweeds, lichens, mosses, liverworts, ferns, and higher plants. An experimental garden of 9 hectares is complementary to all studies.

Current activities

Taxonomy: The process of recognition and description of all elements in the flora of New Zealand, native, naturalised, adventive or horticultural, is a continuing one.

Two volumes of the *Flora of New Zealand* have been published, both dealing with native species; the third treating naturalised monocotyledonous plants is scheduled for publication in 1979. Work is advancing on a further volume about naturalised dicotyledons, and on another book concerned with all the grasses in this country.

Specialist taxonomic studies are being made on lichens, on freshwater and marine algae, and on higher plants. Chemotaxonomy continues in the native genus *Carmichaelia,* and is being concluded on the native hemiparasites.

Continuing services include: identification of plants especially weeds of crops, pastures, roadsides and waterways; advice on legislation concerning plants; recommendations for plant introduction; advice on poisonous plants; forensic botany.

Ecology and conservation: Few landscapes have been modified so extensively in such a short time as those of New Zealand. Over the last few decades, pressure of development and exploitation has come to bear heavily on the remaining lowland natural ecosystems, including grasslands, forests, and wetlands. It is therefore imperative to know what is adequately protected within existing reserves, and to identify further areas where nature protection should be the primary land use. To this end, Botany Division has been carrying out biological evaluations of the reserves administered by the Department of Lands and Survey, and of four of the National Parks, i.e. Tongariro, Egmont, Nelson Lakes, and Westland. *Plants and Landscape in Westland National Park* has been published by the National Parks Authority. Opportunities to propose new reserves arise where the Division is involved in these surveys, e.g. in the areas covered by the beech forest utilisation proposals, and in connection with environmental impact assessments. In another approach, rare and endangered species are being listed, and the adequacy of their protection appraised.

Pollen morphology and Quaternary botany: Clear, detailed descriptions of pollen grains are basic to identification in pollen analysis and as a tool for the taxonomist. The first may add precision to the reconstruction of vegetation and climate history; the second may reveal unexpected relationships or differences between plants. The preparation of a pollen atlas of native dicotyledonous plants is a current project designed to meet these criteria.

The greatest effort in pollen analysis is directed towards an understanding of vegetation and climate history during the last glaciation (Otiran) and the present interglaciation (Aranuian). Collaboration with specialists in other disciplines, e.g. geology, pedology, involved in Quaternary studies, is sought, and radiometric techniques are used wherever possible.

Reproductive biology: Studies in this field deal with the process leading to the production of seed (flowering times, pollination mechanisms, and fertilisation) as well as seed dispersal and germination. These are crucial stages in the life history of a plant. The breeding systems influences the genetic architecture and variability of the next generation, while the size and extent of that generation is determined by seed production, dispersal, and germination, as well as the establishment of seedlings. Our present work involves observational and genetical studies of self-fertility, self-sterility, apomixis, male-sterility, dioecism, and sex-ratios, in such genera as *Cortaderia, Euonymus, Fuchsia, Gentiana, Mentha, Pseudowintera, Rosa,* and native umbellifers. Germination experiments on a wide range of species are carried out in a specially equipped laboratory and a summary of results is being prepared for publication. Seed longevity is being determined for *Leptospermum ericoides* and *L. scoparium,* also *Metrosideros carminea, M. excelsa, M. perforata, M. scandens* and *M. umbellata.*

Structure and form: This includes a survey of native woods, and developmental studies of the peculiar juvenile forms of several native plants.

CHEMISTRY DIVISION

Gracefield Road, Lower Hutt
POSTAL ADDRESS: Private Bag, Petone
TELEGRAMS: CHEMDIV Petone TELEPHONE: 666 919 Wellington

DIRECTOR: I. R. C. McDonald, MSc, FNZIC, ARIC
Sectional activities: Applied Chemistry; Food; Forensic; Geochemistry; Geothermal; Information; Inorganic Materials; Natural Products; Organic Chemistry; Pharmaceutical; Physical Chemistry; Spectroscopy; Toxicology; Water

DISTRICT LABORATORIES

AUCKLAND:
Broadcasting House, Durham Street West. Postal Address: P.O. Box 2224
Telegrams: CHEMDIV. Telephone: 798 840
Government Analyst: D. F. Nelson, MSc, DCrim *Cal*, FNZIC.

CHRISTCHURCH:
Government Buildings, Worcester Street. Postal Address: P.O. Box 2112
Telegrams: CHEMDIV. Telephone: 65 419
Government Analyst: G. R. Scott, MSc, FNZIC.

WAIRAKEI:
State Highway 1, Wairakei. Postal Address: DSIR (Chemistry Div.), Wairakei, Private Bag, Taupo.
Telegrams: CHEMDIV Taupo. Telephone: 48 211 Taupo.
Officer in Charge: W. A. J. Mahon, MSc, MNZIC.

STAFF: 124 scientists, 52 science technicians, and 48 supporting staff.

The main functions of Chemistry Division are: to undertake long-term chemical research important to the development of the resources and social needs of New Zealand, wherever possible anticipating future requirements for technical knowledge; to carry out specific investigations to raise the efficiency of New Zealand industry, both private and State, and to promote new industries; to serve as a central laboratory for the chemical requirements of Government departments, undertaking specific work and co-operating in joint projects; and to encourage the growth of organisations, both Government and private, able to supply improved technical services to industry.

Current projects

(A complete account is available in: Chemistry Division 1976 Handbook, *DSIR Information Series No. 119*).

Human health: analysis of foods to ensure compliance with the Food and Drug Regulations (1973); analysis of drugs available on the New Zealand market (the MEDIQUAL programme); suitability and safety of containers for food and drugs; toxic elements and compounds, pesticide residues, calcium and phosphorus in the New Zealand diet; nutritional composition of special foods; dissolution of oral dosage forms of drugs; absorption and pharmacokinetics of drugs; particle-counts in parenteral solutions; honey quality; pottery glaze compositions; nitrate/nitrite levels in fruit and vegetables; monitoring pesticide levels in food; determination of pesticide residues in fruit and vegetables; persistence of lindane insecticide in pasture soils; production of experimental water-dispersable formulations of short-lived insecticides for grass-grub control; composition of citrus juices and wines.

Organic and natural products: the structure of lignin and condensed tannins; a study of the colour and astringency of fruits and wines; the yield and composition of N.Z. seed oils; chemistry of mammalian pheromones; the classification of native plants by chemical methods; chemistry of lanolin; health aspects of solanum alkaloid levels in potatoes; photo-chemistry of heterocycles; general aid to government and industry in organic chemistry (analysis and spectroscopy).

Waters: investigation of water-supply quality and pollution incidents; analytical methods development and interlaboratory testing (the CHEMAQUA programme); chemistry of the Lower Hutt and North Canterbury Plains aquifers; land disposal of effluents; nutrient inputs and levels in the Pauatahanui Inlet (Pauatahanui Environmental Project); geochemistry of spring waters.

Forensic and toxicological science: identification of illicit drug seizures; examination of exhibits submitted by the Police Department; analysis of post-mortem samples of human organs; grouping blood stains and other body fluids; identification of tool marks; specialist photography; therapeutic drug levels in blood; Transport Act samples for blood alcohol; evaluation of breath testing devices; cannabis levels in body tissues.

Geochemistry and geothermal: inorganic analysis of geologic materials; rock and mineral analyses; monitoring and elucidation of hydrothermal phenomena involved in geothermal power production; mechanisms of heavy metal and mineral transport and deposition in geothermal waters; spectrophotometry of high-temperature solutions; investigation of volcanic fluids and gases; chemical engineering studies of two-phase flow; environmental geochemistry; utilization of hot waters from geothermal and thermal power stations, e.g., for district heating.

Consumer services quality assurance of manufactured products; preparation of specifications for, and testing of, paints, detergents, lubricants, etc. for Government purchase contracts.

Building materials: protection of structural steel against corrosion; weather resistance of paints; performance of plastics and adhesives; cladding systems and attachment of exterior trim to high-rise buildings; investigations on cement and cement admixtures, concrete, pumice concrete, aggregates, and fly-ash concrete.

Physical chemistry and spectroscopy: X-ray crystallographic, electron spin resonance and Mossbauer spectroscopic studies of minerals and metallo-organic compounds; crystallographic studies of drugs, natural organic compounds and minerals; tracing sources of toxic metals with emission spectroscopy; physical and chemical properties of coals; computer modelling of geothermal down-hole conditions; statistical analysis of blood alcohol analytical results.

CHRISTCHURCH INDUSTRIAL DEVELOPMENT DIVISION

244 St Asaph Street, Christchurch
POSTAL ADDRESS: P.O. Box 1152, Christchurch
TELEGRAMS: RADEV Christchurch
TELEPHONE: 62 369 Christchurch

DIRECTOR: T. H. Scott, BE Elec Mech, CEng, MIEE, MNZIE
Standards Testing and Product Development: F. W. Seldon, BE, CEng, MIEE, MIMechE
Electronics and Acoustics:
Machine Development: A. A. J. Robertson, BE, AISE
Liaison and Information: D. A. Hills, BSc, FNZIC, FPRI
Materials Science and Metallurgy: G. L. Allen, BScEng *Calif*
Electrical Engineering: B. J. Halpin, BE(Hons) Elec, MNZIE
Industrial Engineering: B. Donohue, BE(Hons)Mech
Instrumentation: S. J. Hough

STAFF: 11 scientists, 18 science technicians, and 12 supporting staff.

The Division promotes the efficient industrial use of equipment, materials, production techniques and human resources. This is accomplished by offering testing services not otherwise available to industry and by carrying out research and development work, the results of which are disseminated in reports, articles, and technical bulletins. These services have been made available to South Island industry for almost 30 years (before 1969 as the University of Canterbury Industrial Development Department).

Current projects

Standards testing and product development: Standards testing of industrial safety belts, safety helmets (a second test rig allows testing to the Australian Standard) and electrical appliances (TELARC registered for this purpose); assistance to manufacturers seeking export markets in Australia; development of further prototype helmets for topdressing pilots.

Instrumentation: calibration to sub-standard accuracy of electrical and air velocity measuring instruments; establishment of metrology section; instrumentation of wind tunnel for forestry research; calibration, manufacture, and minor repairs of industrial instruments; advising on instruments and their application, with emphasis on process control; photographic work for the division.

Materials science: metallurgical services; wood engineering for sports equipment; lightweight concrete building panels; solar energy components and systems; recycling of plastic waste; development of alloys for thermal fuses; medium temperature insulation based on geothermally-derived silica; salt spray resistance of various coating systems.

Electronics and acoustics: integral ear-pieces and acoustic design of agricultural pilot's helmet; improved tracking devices to monitor movements of chamois; acoustic measurements and advisory work for local bodies, planning authorities, industry and commerce.

Machine development: factory evaluation of a pelt-removing chain for freezing works; assistance and advice on machine development in industry; construction of a truck-mounted carpet cleaning machine; development of an advertising unit for buses.

Industrial engineering: measurement and monitoring of engineering variables such as pressure, temperature, flow-rates and flow characteristics, force, acceleration, velocity and displacement, weight, thickness, hardness, surface texture; laboratory calibration of load cells and accelerometers; materials and product testing for strength, stress distribution and mechanical characteristics; analyses of stress and vibration of components and systems; dynamic balancing; machine alignment; strength and fatigue tests on trolleys and meathooks for freezing works.

Tests are being carried out to determine the dynamic stress distribution for tow-bar fittings for vehicles to assist in establishing a N.Z. Standard Specification on manufacture and assembly taking safety into account.

Electrical engineering: product development and testing of 400 V industrial and commercial equipment including:—switchgear, miniature circuit breakers, earth-leakage circuit breakers, rewirable and HRC fuses, busbars and distribution boards, and welding transformers; tests and development assistance with 11 kV switchgear; H.V. a.c., input and loss tangent tests on H.V. insulators, bushings and motor and generator stator windings; design burdens for a C.T. test set; miscellaneous testing and calibration of instruments, potential transformers, water conductivity lead-acid accumulators; write computer program for Fourier analyses of power system voltage waveform; general advice and assistance to industry on electrical problems; design and construct current-limiting reactors and resistor and point-on-wave switching device for 10 000 A test station; construct 50 kV portable test bench; assist university with problems with their Schering bridge, impulse generator and H.V. transformer test facilities; theoretical studies of short circuit transient currents and C.T. performance with different burdens.

Liaison: preparation of publications issued by the Division; arranging articles in outside journals; contact with news media; improving liaison with South Island industry; ensuring that every enquirer is put in touch with someone who can answer his question, give direct advice, or undertake the necessary testing or research; providing a specialist service in rubber technology.

CROP RESEARCH DIVISION

Ellesmere Junction Road, Lincoln
POSTAL ADDRESS: Private Bag, Christchurch
TELEGRAMS: PLANTLAB Christchurch TELEPHONE: 228 019 Christchurch

DIRECTOR: H. C. Smith MAgrSc, PhD *Cantab* FNZIAS
Agrometeorology: J. W. Sturrock, BSc, DipAgr, PhD *Edin*
Agronomy: D. J. G. Davies, DipAgr, DipAgrSc
Cereals: G. M. Wright, MSc
Crop Evaluation: A. D. Hall, BAgrSc, DipAgr
Field Crops: T. P. Palmer, MAgrSc
Fruit and Glasshouse: I. K. Lewis, MSc, PhD *Cantab,* DipHortSc
Applied Genetics: F. R. Sanderson, MSc, PhD
Potato-Food Technology: A. S. Bedi, BSc, MAgrSc, PhD *Edin*
Process Crops: J. Lammerink, IrAgr *Wagen*
Seed: J. P. Malcolm, MAgrSc
Vegetables: H. J. Giesen, IrAgr *Wagen*

SUBSTATIONS

OTARA: Crop Research Station, P.O. Box 61060. R. K. Bansal, MSc, NDK, PhD *Wisc*
PALMERSTON NORTH: Private Bag. J. M. McEwan, MSc, PhD *Mnb*
GORE: Crop Research Station, Private Bag. D. S. C. Wright, MAgrSc, PhD *McGill*

STAFF: 34 scientists, 35 technicians, and 23 supporting staff.

The Division is responsible for breeding improved cultivars of arable and horticultural crops to increase crop productivity, and conducts research in crop processing, food technology, genetics, plant breeding, and seed production.

Current projects

Field crops: development of improved lucerne cultivars; development of hybrid sweetcorn and maize cultivars for different climates; breeding swedes for resistance to clubroot and rape for resistance to aphids; evaluation of new crop cultivars in comparison with existing local and overseas cultivars; maintenance of breeders' seed of all Government-certified cultivars of wheat, barley, oats, peas, kale, rape, and turnips and distribution to growers through appointed agents.

Industrial crops: breeding high-yielding, high-quality spring and autumn wheats; breeding high-yielding barleys and oats for processing and feed grain; breeding peas for processing, and evaluating other legume crops; breeding rape and linseed for oil; development of the peppermint crop for oil.

Environment: studies of shelter belts and crop reaction to wind; crop response to irrigation under different wind exposures; alteration of plant form and dry-matter distribution; studies on the development of *Solanum* as a drug crop and agronomy of berry production; evaluation of local and imported strains of tree nut crops for shelter, timber, and nut production; infra-red aerial photographic assessments of grass grub damage to pasture, stem nematode injury to lucerne, and extent of windblown timber from severe storms; evaluation of aerial photographic assessments of plant disease and plant protein levels.

Horticultural crops: improvement of vegetable crops for processing and for fresh market, including methods of seed production for F1 hybrid cultivars; breeding potatoes for fresh market and for processing; evaluation of culinary herbs; breeding and selection of raspberries, strawberries, and apricots for improved flavour and increased yields.

Genetics: screening lucerne cultivars for resistance to stem nematode and blue-green aphid; screening cereal cultivars for resistance to barley yellow dwarf virus, mildew, leaf rust and aphids; ecology of aphid vectors in co-operation with Plant Diseases Division, Lincoln; evaluation of screening techniques for tolerance to *Verticillium* wilt in potatoes; evaluation of potato cultivars for resistance to potato cyst nematode, and determination of yield loss due to the nematode.

ECOLOGY DIVISION

66 Bloomfield Terrace, Lower Hutt
POSTAL ADDRESS: Private Bag, Lower Hutt
TELEGRAMS: ECOLOGY Lower Hutt TELEPHONE: 694 859 Wellington

DIRECTOR: J. A. Gibb, MA, DPhil *Oxon*
Biological Survey and Birds in Agriculture: D. G. Dawson, DPhil *Oxon*
Orongorongo Valley Field Station (Forest Ecology): R. E. Brockie, PhD *Well*
Beech Forests and Reserve Management: R. H. Taylor
Freshwater Ecology: E. White, PhD *Dunelm*

SUBSTATIONS

TAITA (laboratory, animal house & workshop): c/- Soil Bureau, Private Bag, Lower Hutt. R. E. Brockie, PhD *Well*
TAUPO: Freshwater Section, Ecology Division, P.O. Box 415. E. White, PhD *Dunelm*
HAVELOCK NORTH: Bird Research Laboratory, DSIR Research Orchard, Goddards Lane. T. P. G. Purchas, PhD *Well*
NELSON: Ecology Division, DSIR, Private Bag. R. H. Taylor

STAFF: 28 scientists, 20 science technicians, and 12 supporting staff.

The Division conducts research on factors affecting the distribution and numbers of animals, the effects of animals on vegetation, and factors affecting the quality of fresh waters.

Emphasis is given to wildlife on farm land, particularly bird damage to crops and bird predation on insect pests, to reactions between plants and animals in forest and other ecosystems not dominated by man, to ecological surveys of areas of special scientific importance, and to problems related to the management of parks and reserves, including off-shore islands. Intensive research concerns the causes, effects and control of the accelerated enrichment of fresh waters. The Division also advises on a wide range of environmental problems and on the auditing of impact reports.

Current projects

Biological survey and reserve management: mapping the distribution of birds and other animals. Surveys of parks, reserves and off-shore islands; effects of browsing mammals on the vegetation, and of carnivores and rodents on native fauna; biology of stoats in National Parks; distribution of wild populations of domestic stock.

Birds on farm land: evaluation of bird damage to crops in Hawke's Bay, and methods of alleviating it, especially with repellents; seasonal changes in food of house sparrows; population biology and movements of starlings in relation to insect control and damage to fruit.

Ecology of native forests: Orongorongo Valley Field Station—studies of vegetational changes emphasising the effects of opossums and goats; phenology of trees and shrubs; litter-fall and seed production. Attempts are being made to explain short- and long-term fluctuations in animal numbers. The influence of climate, food supply, behaviour, reproductive performance and predation on the population densities of goats, opossums, rodents, cats, stoats, birds and insects is being studied. Special attention is devoted to the rate at which the composition of the forest is changing, particularly through the death of rata and other species as a result of browsing by opossums.

Nelson Substation—numbers, movements and hunting pressure on red deer in the Nelson Lakes district. Studies of birds and mammals in relation to forest management; methods of counting birds in forests; bird numbers related to habitat, food supply and predators; requirements for biological reserves. An attempt is being made to measure the extent to which lowland forest, already much reduced in area, serves as a winter refuge for birds frequenting forest at higher altitudes in summer.

Freshwater research: improved methods for measuring aquatic plant nutrients, especially phosphate and nitrate; the distribution and dynamics of plant nutrients in lake sediments, and the relationships of land use to lake chemistry; the quality of groundwater in the Taupo and upper Waikato River catchments; water flow characteristics on pumice soils; nitrogen fixation by floras of the water and sediments and their contribution to the total nitrogen budget; the contribution of ultraplankton to the primary productivity of oligotrophic lakes; bioassay technology; population studies of invertebrate faunas relative to catchment land use; environmental effects of geothermal power development.

ENTOMOLOGY DIVISION

120 Mount Albert Road, Auckland 3
POSTAL ADDRESS: Mt Albert Research Centre, Private Bag, Auckland
TELEGRAMS: ENTLAB Auckland TELEPHONE: 893 660 Auckland

DIRECTOR: J. M. Hoy, DSc
Biological Control: E. W. Valentine, BAgrSc, DIC
Ecology: C. H. Wearing, PhD *Lond,* DIC
Nematology (joint section with Plant Diseases Division): F. H. Wood, PhD
Physiology: O. R. W. Sutherland, PhD *Cantab*
Rearing: P. Singh, AIARI, PhD *New Delhi*
Systematics: J. S. Dugdale, BSc
Pathology: J. F. Longworth, MSc

SUBSTATIONS

LINCOLN: c/- Crop Research Division, J. A. Wightman, PhD, DIC
PALMERSTON NORTH: c/- Grasslands Division, M. J. Esson, BSc

STAFF: 37 scientists, 37 science technicians and 9 supporting staff.

The Division conducts research on insects, mites, and plant nematodes, with emphasis on those species of economic importance in agriculture and horticulture. Research is oriented towards the development of control methods involving minimum use of toxic chemicals and the exploitation of beneficial species.

Current projects

Biological control: introduction of parasites of noctuid caterpillars; search for controlling agents of black beetle; surveys for predator and parasite establishment; control of nodding and Californian thistle by phytophagous insects; use of insecticide-resistant predaceous mites; predators and parasites of aphids; legume pollination.

Ecology: resistance of pasture plants to grass grub, porina, clover case bearer, stem weevil, and lucerne aphid; energetics of grass grub; hill country entomology; effects of pesticides on earthworms; ecology and management of lucerne pests, brassica pests, apple pests, and kiwifruit pests, particularly integrated mite control; ecology and taxonomy of aphids; pesticide resistance of horticultural pests; nationwide leafroller survey; use of pheromones.

Nematology: studies on biology and control of stem eelworm in lucerne; root-knot nematodes in clover, lucerne, poroporo, and vegetables; dagger nematode in apricots; lesion nematode in apples, cherries and tobacco; life history, population dynamics, yield effects, and control of potato cyst nematode; biology and control of bulb nematode in ornamentals and vegetables; screening white clover and lucerne for resistance to nematodes; role of nematodes in "pasture decline" syndrome; environmental factors affecting nematodes; nematode diseases of Cook Islands; insect parasitic nematodes as potential controlling agents; taxonomy of cyst-forming nematodes.

Physiology: behaviour of pasture and crop pests with emphasis on the role of chemical attractants, repellents, feeding stimulants, and deterrents; isolation and identification of chemical factors conferring resistance to grass grub and black beetle; insect defence secretions; chemistry of pheromones of horticultural pests and use in survey and control programmes; insect chemoreceptors; electrophysiology of behavioural responses of grass grub, codling moth, and leafrollers.

Rearing: artificial diets and mass-production for economically important insects; nutritional physiology and diseases; aseptic rearing; role of antibiotics, antimicrobial food additives, and antimetabolites in diets; hormonal physiology and investigations into entomologically active compounds from plants.

Systematics: survey, identification, classification, and characterisation of the New Zealand terrestrial and freshwater arthropod fauna; curation of New Zealand arthropod collection; association of immature stages with adults; life histories; relationships with host plants; insular faunas including Kermadecs and subantarctic islands; biogeography; comparative faunal surveys; conservation; epigean and phreatic faunas; arthropods of Cook Islands, Niue, Tonga, and Samoa.

Pathology: characterisation and identification of New Zealand's more important lepidopteran baculoviruses with a view to evaluating their safety; survey of pathogens of major pasture pests, with emphasis on black beetle; studies on insect picornaviruses.

GEOLOGICAL SURVEY

State Insurance Building, Andrews Avenue, Lower Hutt
POSTAL ADDRESS: P.O. Box 30368, Lower Hutt
TELEGRAMS: GEOLOGICAL Lower Hutt TELEPHONE: 699 059 Wellington

DIRECTOR: R. P. Suggate, MA *Oxon,* DSc, FRSNZ
Project Geology: G. W. Grindley, MSc, DSc, FRSNZ
Paleontology: N. de B. Hornibrook, MSc, DSc, FRSNZ: G. R. Stevens, MSc, PhD *Cantab*
Technical Liaison and Information: S. N. Beatus
Petrology: W. A. Watters, MSc, PhD *Cantab*
Engineering Geology: L. E. Oborn, AOSM, MAIMM
Economic Geology: B. N. Thompson, MSc
Earth Deformation Studies: G. J. Lensen
Petroleum and Basin Studies: H. R. Katz, PhD *Zurich;* P. B. Andrews, MSc, PhD *Texas*

DISTRICT OFFICES

AUCKLAND: Otara Research Station, Otara Road, Papatoetoe P.O. Box 61012, Otara. Telephone: 49 529 Papatoetoe. J. C. Schofield, MSc.
ROTORUA: NZBC Building, P.O. Box 499. Telephone: 82 189 Rotorua. E. F. Lloyd.
TURANGI: c/- Ministry of Works, Private Bag. Telephone: 7799 Turangi. B. D. Hegan, MSc.
HUNTLY: P.O. Box 18. Telephone: 88 140 Huntly. A. M. Sherwood, MPhil.
NELSON: Private Bag. Telephone: 81 081, 81 082 Nelson. M. R. Johnston, BSc (Hons), PhD.
CHRISTCHURCH: Geology Building, University of Canterbury. Private Bag. Telephone: 792 260 Christchurch. M. G. Laird, MSc, DPhil *Oxon.* Sedimentation Laboratory: Location and address as Christchurch District Office. G. J. van der Lingen, MSc, PhD.
TWIZEL: c/- Ministry of Works, Private Bag. Telephone: 809 Twizel. D. F. MacFarlane, BSc (Hons), MAppSc.
CROMWELL: P.O. Box 64. Telephone: 50 011 Cromwell. R. Thomson, BE.
DUNEDIN: P.O. Bldg, Moray Place. P.O. Box 5342. Telephone: 774 050 Dunedin. I. C. McKellar, MSc.
GORE: DSIR, Private Bag, Gore. Telephone: 84 015 Gore. M. Issac, BSc (Hons), PhD

STAFF: 78 scientists, 42 science technicians, and 22 supporting staff.

The Geological Survey, founded in 1865, is the oldest Government scientific organisation in the country. Its work covers all major fields of basic geology. It acts as geological consultant to all Government Departments (but principally Works, Mines, Electricity, and Railways), to local authorities, and to many private companies and individuals.

The Survey issues geological maps, reports, bulletins and scientific papers. These, with the extensive collections of rocks, minerals, and fossils in Lower Hutt, form an invaluable store of knowledge about the geology and mineral resources of New Zealand. In recent years the Survey has extended its explorations to Pacific Island Territories and Antarctica.

Current projects

Regional geology: regional geological mapping for publication at scales of 1:63 360 and 1:50 000 (metric) continues in many parts of the country particularly Auckland, Wairarapa, Nelson, and Otago; emphasis now being placed on sedimentary basins with rocks of Cretaceous to Pleistocene age; production of maps at 1:25 000 for industrial and groundwater uses around Auckland and Christchurch; final proof reading and press checks of Volumes I and II of *The Geology of New Zealand,* recording 100 years of geological observation.

Paleontology: basic systematic study of fossils and their occurrences in New Zealand rocks; regional studies leading to ecological, climatic, and geographical inferences in geological history; stratigraphic control for oil and coal drilling by determining ages of microscropic fossils in drill cuttings; computerisation of fossil records, including their occurrence in all areas and rock formations of New Zealand; studies of Pliocene limestones in Hawke's Bay and Cretaceous rocks of east coast North Island in relation to petroleum potential; geological comparisons between New Zealand, Australia, Antarctica, and New Caledonia carried out under the auspices of an international co-operative programme of UNESCO.

Sedimentology: studies of sand and gravel on modern beaches, rivers, and dunes; similar study of fossil sediment in New Zealand rocks, particularly greywacke and sandstone-mudstone; application of these techniques to regional mapping and applied geology.

Mineral and energy resources: regional geological mapping of mineralised areas in Coromandel and north-west Nelson; studies of specific mineral deposits: metallic minerals, non-metallic minerals (including limestone, silica sand, and lump silica); water resources (principally Northland, Nelson, and Canterbury Plains); coal exploration (Waikato, West Coast, and Southland); petroleum studies (including geological advice to oil companies), fossil determinations, regional mapping, compilation of data on potentially economic areas and assistance to countries of the south-west Pacific on petroleum exploration; advice on siting of geothermal wells and reporting on subsurface geology and fluid rock reactions; assistance to other countries on geothermal exploration, particularly Indonesia and the Philippines.

Petrology: studies of New Zealand igneous and metamorphic rocks; study of volcanic lavas and ashes from Ruapehu, Ngauruhoe, and White Island, to assist understanding of eruptive mechanisms; study of hydrothermally altered rocks and associated minerals in connection with the search for geothermal steam; research in New Zealand minerals and meteorites; investigation of rocks and minerals—especially clay minerals—using X-ray, infra-red, and differential thermal analysis techniques; study of coal reflectance and composition of coal ash in connection with the investigation of New Zealand coal resources; analysis of rocks using X-ray fluorescence.

Earth deformation studies: co-operation in an inter-departmental and University programme of earth deformation studies; tectonic mapping at a scale of 1:50 000, showing fault traces and deformed surfaces; monitoring of horizontal and vertical movements in tectonically "active" areas; application to siting of major constructions and to town planning.

Engineering geology: studies of the geology, stability, and construction material requirements of dams, tunnels, highways, railways, bridges, ports, and other building sites; emphasis on hydro-electric developments; slope stability investigations; earthquake microzoning studies of the relationship between the geology of parts of cities and the response of buildings on them to earthquakes; laboratory studies of the engineering properties of rocks.

Environmental geology: geological studies for, and auditing of environmental impact reports on engineering, mining, and industrial projects; town and country planning and geology for land inventory.

Special projects: Studies in stratigraphy and paleontology to refine geological correlations between New Caledonia and New Zealand (under the auspices of the International Geological Correlation Programme). Further studies in stratigraphy and tectonics between western South Island, North Victoria Land, Antarctica, and south east Australia (also an IGCP Project). Paleomagnetic investigations in New Zealand and West Antarctica to determine latitudinal position of the New Zealand microcontinent at various times over the past 150 m.y. Compilation of geologic, tectonic, and mineral resources maps of New Zealand and the Transantarctic Mountains, Antarctica for the Circum-Pacific Map Project.

GEOPHYSICS DIVISION

Observatory Reserve, Salamanca Road, Wellington
POSTAL ADDRESS: P.O. Box 1320, Wellington
TELEGRAMS: GEOPHYSICS Wellington TELEPHONE: 738 208 Wellington

DIRECTOR: T. Hatherton, OBE, DSc *Lond,* PhD *Lond,* DIC, FRSNZ

SECTIONS AND OBSERVATORIES

DRILLING SECTION: Geophysics Laboratory, Gracefield Road, Lower Hutt.
Officer in Charge: J. E. Hoffman
GEOPHYSICAL SURVEY: Geophysics Office, Observatory Reserve, Kelburn.
Superintendent: W. I. Reilly, BA, DSc, AOSM
Geophysics Laboratory: Gracefield Road, Lower Hutt.
Officer in Charge: R. G. Jenkins
Geothermal Laboratory: c/- Ministry of Works and Development, Taupo.
Officer in Charge: T. M. Hunt, MSc, PhD
SEISMOLOGICAL OBSERVATORY: Geophysics Office, Observatory Reserve, Kelburn.
Superintendent: W. D. Smith, MSc, PhD *Calif*
APIA OBSERVATORY: Apia, Western Samoa.
Superintendent: C. A. Y. Hewson
RAROTONGA OBSERVATORY: Rarotonga, Cook Islands.
Officer in Charge: A. F. Cresswell, NZCS

STAFF: 34 scientists, 34 technicians, and 8 supporting staff.

Geophysics Division activities cover not only New Zealand, but also a large area of the South Pacific extending from Samoa to Antarctica.

The Division, through its Geophysical Survey, investigates the types and structures of subsurface rocks. Such knowledge is required at engineering sites for mineral and geothermal exploration, and for improving basic understanding of conditions and processes deeper in the Earth. The Drilling Section provides direct information about rocks, temperatures, or water conditions at depth, and shotholes for seismic exploration.

Through its Seismological Observatory the Division studies earthquakes and their distribution and effects in New Zealand. The Observatory contributes readings to international organisations for global analysis, and its Pacific Island stations form part of the Pacific-wide system for tidal-wave warnings. The Observatory also controls New Zealand Standard Time and disseminates it by radio and wire links.

All sections contribute to the study of the deformation of New Zealand which results in the country's earthquakes, volcanoes, mountains and geothermal fields.

Current projects

Seismological observatory: monitoring earthquakes around Lake Pukaki to determine any seismic effect of lake raising; monitoring local earthquakes in the Wellington region to detect any variation in pattern of occurence; monitoring radon content of groundwater, as a possible earthquake precursor; developing systems for automatic earthquake analysis; studies of long-term fluctuations in New Zealand seismicity; studies of likely variation of earthquake shaking throughout New Zealand; reassessment of local earthquake location procedures and magnitude determinations.

Variation of earthquake activity: Detailed studies of patterns of earthquake occurrence in New Zealand are now aided by a computer listing of all known events. One such study concerns the variation in the rate of earthquake occurrence and energy release in New Zealand. The most active periods of earthquake activity were from 1843 to 1855 and 1929 to 1934, but there was also a general increase in the number of earthquakes after the magnitude 7 earthquake near Inangahua in 1968. In this period there was also an unusually large proportion of small shocks compared with larger ones, suggesting that the occurrence of the major earthquake had affected the mechanism of earthquake generation over much of the country. The overall level of activity has remained low since 1934, and if the past pattern is to be repeated, this inactive period may extend for another 10 years or so.

Geophysical survey: location and estimation of size of geothermal fields; monitoring of geophysical parameters on North Island volcanoes; assistance with exploration for coal and oil; studies of groundwater availability and quality; geophysical studies at engineering sites; marine geophysical surveys around New Zealand; analysis of earth deformation and secular change in gravity; interpretation of gravity and magnetic data in the Taranaki-Wanganui area.

Energy: Government's decision to enter the field of onshore oil prospecting, precipitated much activity within the earth science sections of DSIR. Most aspects of oil exploration are highly specialised and equipment intensive, and DSIR Divisions have not been equipped to participate directly in the search for oil which has previously been a private enterprise. Nonetheless such resources that Geophysics Division has were brought to bear in the initial prospecting stages. The Division's gravity map series outlines possible prospective areas well in some regions and a seismic survey was mounted in the Ashley Forest (north Canterbury) to study a structure there.

Geophysical methods are being increasingly used in the search for and estimation of coal resources. Gravity surveys to find the thicknesses of the sedimentary sections have been made over the basins of the eastern Southland coalfields. Well-logging using Division-built equipment has successfully determined the presence and thicknesses of coal seams down boreholes at Huntly more precisely than can be done from drillers logs. Use of seismic methods for coalfield investigations is limited by the lack of appropriate equipment and the geological nature of coal measures and overlying rocks in New Zealand.

In accordance with the 1977 Budget decision to accelerate development of geothermal energy, the effort devoted to this activity by Geophysics Division has almost doubled. Because exploration for geothermal fields has continued unabated over the past 15 years, in spite of the vagaries of power planning, prospecting is well ahead of possible exploitation in the Taupo-Bay of Plenty area. Recently, important indications of heat have been obtained at Mokai, Atiamuri, and Mangakino, within the western exotic forest areas. The increased effort should also allow the group of hot springs running through Waikato, Auckland, and Northland to be prospected more thoroughly. Of this group only Ngawha has been investigated by geophysical methods.

GRASSLANDS DIVISION

Fitzherbert West, Palmerston North
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TELEGRAMS: GRASSLANDS Palmerston Nth. TELEPHONE: 68 019 Palmerston Nth
TELEX: 31285

DIRECTOR: R. W. Brougham, DSc
Agronomy: J. A. Lancashire, BSc, MAgrSc
Pasture Ecology: W. Harris, PhD *Cantuar*
Plant Breeding: W. Rumball, PhD *Massey*
Plant Nutrition: P. R. Ball MAgrSc
Genetics: K. K. Pandey, PhD *Lond,* DSc *Lond,* AIARI, FLS
Turf: P. S. Evans, MSc, PhD *Massey*

REGIONAL STATIONS

KAIKOHE: P.O. Box 194. P. J. Rumball, MAgrSc
BALLANTRAE: c/- Grasslands Division, Private Bag, Palmerston North M. G. Lambert, MAgrSc
LINCOLN: c/- Crop Research Division, Private Bag, Christchurch. E. W. Vartha, MAgrSc, PhD *Massey*
GORE: Private Bag. A. J. Harris, MAgrSc

STAFF: 52 scientists and 98 supporting staff.

Grasslands Division undertakes research in plant and pasture improvement and pastoral agriculture. Through a small network of Regional Stations these activities encompass the warm temperate regions of Northland centred at Kaikohe, South Island high country centred in the Mackenzie Basin, moist and wet North Island hill country centred in the lower Ruahine Range (Ballantrae), intensive Southland sheep-farming centred at Gore, dryland Canterbury regions centred at Lincoln and Kirwee, and alluvial flatlands centred at Palmerston North and the Kairanga Plains (Aorangi). By collaborative research efforts with the Ministry of Agriculture and Fisheries, the Forest Service, the agriculture faculties of universities, and progressive farmers, the Division's research effort, especially in plant improvement, is spread over most climatic and geographic regions of the country.

The Division also has a national responsibility for the production of elite seed (Nucleus and Breeders) of a large number of herbage cultivars bred by the Division and for ensuring evaluations of these in many overseas countries for possible acceptance on the National Lists of Herbage Cultivars of these countries. In collaboration with MAF it is involved in aspects of seed certification and evaluations of overseas herbage cultivars for suitability of use in New Zealand agriculture. A seed introduction service for herbage plants is also provided for MAF, the agriculture faculties of universities, some units of the Forest Service and for the Division's own use.

Current projects

Agronomy: species evaluations under mowing and grazing; aspects of pasture utilisation; feeding value of species and cultivars; animal production; animal disorders; plant and pasture establishment; plant response to weedicides, pesticides and fungicides; seed production; seed certification.

Ecology: temperature, light intensity, and defoliation responses; modelling of plant growth; plant and species competition; plant distribution and successional changes; pasture management and production.

Genetics: molecular and biochemical genetics; cytogenetics; genetics of breeding systems and of rhizobia; genetic transformation in plants.

Plant Breeding: main breeding efforts are:

Grasses: ryegrasses; cocksfoot; timothy; *Bromus; Festuca* and *Lolium* × *Festuca* hybrids; browntop; crested dogstail; *Phalaris;* Yorkshire fog; subtropical species.

Legumes: white, red, and alsike clovers; lotuses; *Ornithopus;* lucerne; sainfoin.

Special topics: plant breeding for better utilisation of phosphate, for tolerance to pasture pests and diseases, for improved nutritive value, for possible bloat resistance, for regional cultivars and for turf grasses.

Plant nutrition electro-physiology studies of plant roots; mechanisms of ion uptake; physiology of phosphorus uptake and movement; mycorrhizal studies; aspects of phosphorus, nitrogen, potassium, sulphur, and minor element nutrition; competition for nutrients; nitrogen fixation and the nitrogen economy of pastoral systems.

Turf research: fertiliser requirements of fine turf; turf management; turf variety evaluations; plant breeding for sports turf.

Regional stations: at all regional stations research effort covers species evaluations; for both the more promising experimental cultivars and certified cultivars investigations are designed to fit these cultivars into agricultural practices in the region. These include botanical surveys, species and pasture establishment, species growth rates, pasture management and species performance, species evaluations, plant breeding, seed production, weed control, nitrogen fixation, plant nutrition and nutrient cycling, chemical composition of pasture, nutritive value of species and pasture, systems of utilisation, and animal disorders related to pasture cultivars.

INDUSTRIAL PROCESSING DIVISION

DSIR No. 2 Building, Gracefield Road, Lower Hutt
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TELEGRAMS: CHEMDIV Petone TELEPHONE: 666 919 Wellington

DIRECTOR: T. Marshall, BSc, BE, FNZIC, AOSM, AIMM
ASSISTANT DIRECTOR: E. Beanland BSc, MSc, ANZIC

STAFF: 35 scientists, 28 science technicians, and 6 supporting staff.

Industrial Processing Division was formed on 1 April 1978 by transfer of staff from Chemistry Division. Its objective is to continue and expand the work previously done by Chemistry Division on the development of pilot-scale industrial processing.

The Division provides a national, pilot-scale production facility where new processes and products can be developed to the stage at which industry can take over and start commercial production. Technical staff from industry work alongside divisional staff at all stages of development.

Research on pollution control and the efficient use and conservation of the country's energy resources are major features of the development work, which emphasises the processing of local agricultural, forestry, mineral, and energy raw materials.

The Industrial Processing Division works in close co-operation with industry, the universities, and research associations to ensure that the latest processing technology is available to manufacturers after it has been thoroughly tested and adapted to local conditions.

Current projects

Industrial and mineral development: processing ironsand concentrates, and recovery of titanium and vanadium from ironsands; investigation of petrochemicals production; recovery and recycling of waste materials; advisory work on energy production and utilisation, petrol substitutes, and waste heat utilisation; pollution abatement; silica and arsenic removal from geothermal water and calcium silicate production; co-operative research on production of gold and other minerals; extraction and processing of peat and lignite wax; extraction and processing of tall oil, resins and waxes from bark and solasodine from solanum; processing of lime oil; processing of agricultural products such as rennet, pectin, leaf protein and essential oils. Fertiliser production; investigation of silicon ferroalloy production; recovery of lanolin from wool-scour effluent; steel production.

Metallurgy: corrosion, stress corrosion, and fatigue behaviour of metals in geothermal steam; non-destructive testing of metal components and structures to minimise failures in service; production of resin-coated silica for foundry shell moulding; advisory work on high-density baling of wool; quality of cans and canning methods for foodstuff containment; investigation of service failures of metal components and structures to help avoid recurrence of failures; advisory work for the New Zealand foundry industry.

INSTITUTE OF NUCLEAR SCIENCES

Gracefield Road, Lower Hutt
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TELEGRAMS: PHYSICAL Lower Hutt TELEPHONE: 666 919 Wellington

DIRECTOR: B. J. O'Brien, MSc, PhD *MIT*
Accelerator Physics: G. J. McCallum, MSc, FInstP
Mass Spectrometry: J. R. Hulston, MSc, PhD *McMaster,* FInstP
Theoretical Physics: M. R. Manning, MSc, PhD *McMaster*
Radiation Chemistry: H. C. Sutton, MSc, PhD *Dunelm,* FRSE
Isotope Chemistry: W. J. McCabe, BSc
Low Background Studies: H. S. Jansen, MSc

STAFF: 31 scientists, 21 science technicians, 10 supporting staff.

The Institute was founded in 1959 as a centre for the application of nuclear techniques to problems of national importance in New Zealand. Although nuclear techniques are based primarily on physical sciences, they have widespread applications in such fields as agriculture, natural resources, human health, industrial development, and studies of the environment. A critical assessment of environmental and other problems associated with radiation from fallout and from other nuclear sources is an important part of the work. The successful use of nuclear techniques depends on the availability of sophisticated modern equipment and versatile staff, well trained in recent development in their subjects. A continuing programme of basic nuclear research plays an important part in such training and in the work of the Institute.

Current projects

Nuclear physics: A 3 MeV Van de Graaff accelerator and related facilities are employed in studies of the nuclear properties of medium weight elements by bombardment with 3 MeV protons. Theoretical studies of nuclear structure with computer aided calculation complement this work. Applications include production of short-lived radioactive isotopes (e.g., carbon, nitrogen, fluorine) and their use in agricultural and medical topics (e.g., translocation of carbon in plants, fixation of nitrogen, bacterial decomposition of water-borne nitrates in lakes); development of X-ray and proton induced X-ray fluorescence techniques for sensitive and non-destructive chemical analysis (e.g., of lead and bromine in air, of trace elements on surfaces, forensic investigations); analysis of light elements in metals by nuclear methods; development of a proton beam micro-probe for analytical purposes; use of a specially constructed pulsed nuclear magnetic resonance device for detection of abnormalities in human blood, and studies of water mobility in tissues.

Radioactive dating: The known decay rates of radioactive isotopes of certain elements are used to determine the time during which such elements have remained fixed in a given specimen. Fossils, soils and ash shower components aged up to 40 000 years are dated using carbon-14;

geological specimens over 100 000 years are dated by the potassium-40 argon method; facilities to employ the strontium-rubidium method for dating geological specimens over 10 million years are now available; lake sediments of less than 100 years age are dated using lead-210 and radionuclides in "fallout"; studies of natural exchange processes including movement of gases from the atmosphere to the surface and deep ocean; movement of carbon from the atmosphere to soil components; origin and movement of natural waters inferred from measurements of their tritium content.

Mass spectrometry: The relative abundance of the stable isotopes of selected elements is studied accurately with specially constructed mass spectrometers. Small variations of these relative abundances occur in natural specimens of different origin. Their measurement gives information on the age, temperature of formation, and origin of mineral ores and of geothermal gases, and also on the origin of natural waters and the mechanism of acquifer recharge. Underground temperatures of new geothermal fields are inferred from isotopic analyses of effluent gases before drilling, whilst continued analyses of geothermal waters evolved at Wairakei show these deep waters originate from downward percolation of rainwater, and have not changed in composition in the past 11 years.

Industrial radiochemistry: River gauging and effluent dispersion studies by tracer dilution technique; underground water flow measurements by similar methods in artesian water systems to determine direction, speed of flow, and dispersion; similar measurements in geothermal areas to assess the feasibility of re-injection of waste hot water; industrial plant kinetics using tracers (e.g., steam separator efficiency, movement of chips in a pulping plant, and mixing efficiency of concrete batching plant); measurement of actinides in the environment.

Radiation chemistry: Chemical and biological effects of ionizing radiation, especially the chemical and biochemical behaviour of the superoxide radical ion; search for chemical agents which modify radiation induced biological effects, using bacteria, as indicators; development of standards for use in fluorescence and phosphorescence; studies of energy transfer mechanisms in irradiated plastics to improve their stability to radiation; use of mutational effects of radiation in agriculture.

Energy: Evaluation of environmental effects and some technical aspects of nuclear power production in New Zealand in case of future need. Research related to energy includes the geothermal studies noted above, and measurement of the long-term accumulation of carbon dioxide in the atmosphere which results from burning fossil fuel. Automatic equipment for such measurements has been installed at Baring Head Lighthouse.

NEW ZEALAND OCEANOGRAPHIC INSTITUTE

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TELEGRAMS: OCEANGRAPH Wellington TELEPHONE: 856 729 Wellington

DIRECTOR: D. E. Hurley, MSc, PhD *NZ*

GROUPS:
Benthic ecology
Coastal and sheltered water environment
Lake surveys
Physical and chemical oceanography
Plankton primary productivity
Offshore minerals and geochemistry
Sedimentology
Regional and local strutural marine geology

STAFF: 25 scientists, 13 science technicians, and 8 supporting staff.

The New Zealand Oceanographic Institute was established to investigate the seas around New Zealand. This very broad charter has been developed along three main lines—*physical oceanography*, the study of water masses, currents and their properties, tides and tsunamis; *marine biology*, the study of the living organisms of the sea; and *marine geology*, the study of the ocean floor and the processes involved in its development. In addition, the Institute has adapted marine techniques for research in New Zealand lakes, resulting, in particular, in the production of an extensive series of lake bathymetric charts.

It is the Institute's task to develop a knowledge of the sea, its life and processes, and to be able to provide the best possible advice to those involved in applied fields such as coastal and offshore engineering, disposal of thermal and sewage effluents, offshore mineral recovery and oil prospecting, fisheries research, preservation of the coastal environment, provision of coastal amenities, or even the information on which to base international boundaries. Nevertheless, its approach is essentially research oriented; practical application comes from increasing knowledge of the fundamental processes involved in the dynamics and life of the seas around us.

The Institute's functions include: basic research on the marine environment; compilation of bathymetric, geological and sediment charts; research on the effects of effluents and pollutants on marine ecological systems, especially in the near shore; the supply of data and advice for applied projects, e.g. harbour works, coastal protection; exploration of marine mineral resources; studies of the dynamic processes of the oceans including upwelling, ocean currents, tides, and tidal effects; lake surveys.

Current projects

Marine biology: benthic ecology of selected environmentally threatened harbours and coastal inlets such as Manukau Harbour and Pauatahanui Inlet; ecology of marine organisms, especially those considered environmentally sensitive such as the cockle *Chione stutchburyi;* taxonomic studies of marine organisms, including echinoderms, copepods, isopods, amphipods, deep-sea crabs, brachiopods, polychaetes and molluscs; regional surveys of primary productivity and nutrient status of New Zealand waters; the importance of coastal zooplankton in the food chain; studies of effects of fouling organisms on power station systems; biological effects of thermal effluents.

Physical oceanography: studies of circulation and seawater properties off the west coast of North and South Islands; circulation of the Kermadec and Bounty Islands regions; detailed studies of the Mid-Tasman convergence; hydrological regimes in coastal inlets; tidal recording; detailed studies of coastal tidal regimes; microstructure of seawater; development of instrument packages for accurate measurement of properties of deep water.

Marine geology: Seafloor geology of the west coast of North and South Islands; surface and sub-surface sediments and structures off south Taranaki and mid-Canterbury; transport of inorganic and biogenic shelf seston (suspended sediment); development of an instrument package to measure seabed boundary conditions of current velocity, pressure fluctuation, variability of sea surface, and sediment movement; sediment transport in Wellington Harbour; Quaternary stratigraphy of shelf and deep-sea areas using coccolith and diatom studies; structure and tectonic history of the New Zealand regional; geology of the New Caledonia and South Fiji Basins.

Mineral exploration: manganese nodule distribution in the Southwest Pacific; phosphorite and glauconite distribution on the Chatham Rise; offshore ironsand distribution, west coasts of North and South Islands.

Chart production: production of coastal, oceanic, and lake bathymetric charts; charts of sediment and marine mineral distribution; biological and physical properties of the sea around New Zealand.

Pauatahanui Environmental Project: multi-disciplinary studies of Pauatahanui Inlet; work on bathymetry, morphology, sediment distribution and transport, littoral and shallow-water ecology, water circulation and properties.

Bibliographies: To assist with background information on areas presently being investigated, bibliographies are being prepared. Recently published or completed bibliographies cover Pauatahanui Inlet; Wellington Harbour; Tasman and Coral Seas; geology of Cook Islands, Niue, Tonga, and Samoa; marine oil spills; estuaries; manganese nodules; mangroves in New Zealand; New Zealand marine geology; heated effluents; Marlborough Sounds; Castlepoint area; Kaipara Harbour; offshore islands; Wairau lagoons and vicinity; Te Anau and Manapouri. Others in preparation deal with the Snares Islands, the Auckland Islands, the natural history of the Cook Islands, and Foveaux Strait.

Public relations: An increasing amount of time is being spent answering queries from school leavers (and younger pupils) concerning future careers in marine biology; several staff members have talked or shown films to school groups and community organisations, and a most successful display and demonstration of the Institute's basic role in conservation (by knowledge) of the seas was presented to over 7000 scouts and many adult visitors at the third Asia/Pacific Scout Jamboree held at Oamaru in January 1978.

PHYSICS AND ENGINEERING LABORATORY

Gracefield Road, Lower Hutt
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TELEX: Physics NZ3814

DIRECTOR: M. A. Collins, MSc (Hons), FInstP, CEng, MIEE
DEPUTY DIRECTOR: A. H. Allan, BE, ElecCivil (Hons)
Chief Engineer: R. A. Morris, BSc
Applied Physics: A. H. McIlraith, PhD *Cantuar,* FInstP
Engineering: R. I. Skinner, BSc (Hons), DSc
Physics: W. H. Robinson, ME Auck, PhD *Ill*
Mechanical Engineering: D. G. McCulloch, BSc, CEng
Electrical Engineering: R. A. Morris, BSc
Environmental Physics: G. McK Allcock, MSc, FInstP
South Island Divisions: R. S. Unwin, BSc, FInstP

BRANCH STATIONS

CHRISTCHURCH: Geophysical Observatory, St Elmo Courts, P.O. Box 2111. Telephone: 791 540, R. S. Unwin, BSc, FInstP.
LAUDER, CENTRAL OTAGO: Auroral Station, Omakau, Telephone: 467 Telex: AURORA NZ5637, J. G. Keys.

STAFF: 110 scientists, 112 science technicians, and 57 supporting staff.

The Laboratory's functions include: basic and applied research in physics and engineering, particularly as related to N.Z. requirements; maintenance of national standards of physical quantities such as length, mass, temperature and electrical quantities; provision of a calibration service for physical measuring equipment; introduction and development of new technology suited to New Zealand's requirements and promotion of its effective use in industry; maintenance of a workshop giving industry access to specialised machine tools and new machine techniques; operation of geophysical observatories at various stations for ionosphere and magnetic observations; establishment and operation of a national computing network for DSIR.

Some current projects

Wood burners: The aim of this programme is to provide basic design data so that potential manufacturers of wood burning devices for domestic and small industrial heating purposes will be encouraged to include clean burning features in their product design. Not only does clean burning meet the requirements of the Clean Air Act, but it results in increased heat yield. Well prepared, seasoned fuel wood (moisture content 15%) has a calorific value of about 16MJ/kg. In a good natural-draught burner about 80% of this energy should be recoverable as useful heat. This means nearly 4 kWh from a 100 × 50 mm piece of pine 450 mm long. The essentials for the clean burning of wood are the same as for the clean burning of other solid fuels such as coal. Sufficient preheated air is supplied to allow complete burning without cooling the volatile components of the fuel. Slow combustion devices with batch fuel loading and with natural- and forced-draught operation have been built and investigated.

Low-cost NC punch: In many manufacturing processes, New Zealand industry is not of sufficient size to justify using the sophisticated equipment employed overseas. An example of this is sheet metal punching. Of the many sheet metal shops in the country, very few can justify the purchase of presently available numerically controlled (NC) punch units. To meet local conditions a project is under way to produce a low-cost NC punch unit. This has involved buying a small general-purpose NC controller, building a positioning table, and mounting this in front of a punch press. By limiting the size of the punched component and the number of hole sizes, the cost of this equipment can be minimised, making it a viable unit for local production.

Heat treatment: The Product Engineering Section is involved in several aspects of the heat treatment of metals. These include a wide-ranging programme of advice and assistance to firms providing heat treatment services throughout the country. The section has assisted in the design and commissioning of a large fluidised bed furnace for the heat treatment of aluminium. This promises advantages over saltbaths and air furnaces, and is the first such furnace in New Zealand. There is a growing interest in the effect of cryogenic (low temperature) treatment on the life of cutting blades. Overseas figures indicate that considerable savings can be made using this treatment. PEL's Production Engineering Section is conducting trials with various factories, building a small-scale treatment plant and setting up laboratory investigations of the wear processes involved. The local heat treatment industry will be advised of the results and encouraged to use the technique where it proves economic.

Pressure standards: In response to a demand for greater accuracy, the National Standards of Pressure held at the Physics and Engineering Laboratory are being upgraded by the introduction of pressure balances. Each pressure balance consists of a loaded free-spinning piston contained in a cylinder but literally floating on the gas whose pressure is to be measured. The pressure is calculated from the mass and area of the loaded piston. At present the accuracy of these instruments is based on a standard barometer, but research is in progress to make them primary standards in terms of mass, length, and time measurements. Pressure balances for measuring gas pressures in the range 2–3500 kPa (0.02–35 atmospheres) and oil pressures up to 17 MPa (170 atmospheres) are available for calibrating secondary pressures standards (such as barometers and dead weight testers) and for precise pressure measurements.

Length and electrical standards: An iodine-stabilised laser is under development which will provide New Zealand with an absolute standard of length reproducible to approximately 1 part in 10^8. To realise this laser, a glass cell containing iodine vapour is placed in the cavity of a helium-neon laser, and by carefully adjusting the cavity length it is possible to observe a small decrease in the output intensity when the laser is tuned to one of the hyperfine absorption lines of iodine. The laser frequency can then be locked on to the absorption line by means of a servo which controls the cavity length. An immediate use for this precise length standard will be in the absolute determination of the quantity of electrical resistance, the ohm, by means of a calculable capacitor. A calculable capacitor equipment has been constructed in which it is possible to produce a small but accurately known change in capacitance. The change is determined by the mechanical movement of an element of the equipment, and it is to measure this movement that the iodine-stabilised laser is required. It is possible to relate the change in capacitance to the value of our 1 ohm standard resistors with an expected accuracy of 1 part in 10^7. It is expected that these measurements will be made within the year.

National computer network: The laboratory is responsible for the implementation, operation and maintenance of a country-wide computer network to provide DSIR scientists with access, via terminals in their laboratories, to the IBM 370/168 and ICL 2980 computers of the Computer Services Division of the State Services Commission. The network is based on PDP-11 minicomputers and offers interactive programming and remote job entry facilities. When the network is complete, services will be available to DSIR scientists wherever they are working in New Zealand.

Earthquake protection for nuclear power plants: An important factor in the design and siting of a nuclear power plant in a seismically active area is the possibility of a serious radiation release under earthquake damage conditions. However, studies at the Physics and Engineering Laboratory have shown that earthquake-generated forces can be reduced to a low level by building the power plant on a base-isolation system of the type recently developed at PEL. The power plant isolation would be provided by special flexible mounts together with metal-beam "hysteretic" dampers. Related isolation systems are currently being installed in several bridges, a tall chimney, and a building in New Zealand. To provide a high level of seismic protection very flexible and deformable mounts would be used for a nuclear plant. Such flexibility may be achieved by stacked sets of laminated rubber mounts of the type currently used under bridge superstructures. Hysteretic damping to further reduce earthquake forces and to prevent excessive deformation of the mounts, may be provided by scaled up steel-beam dampers of a type already developed at PEL for bridge protection. Alternatively hysteretic damping might be provided by using lead beams within the laminated rubber mounts. While the above system is a practical means of isolation from earthquake attack, development of isolator components is continuing. Flexible mounts using lubricated and non-lubricated PTFE layers are being studied and may lead to nuclear plant isolators of increased effectiveness and reduced cost. Several patents on these, and related devices, have been taken out.

Energy farming: If present Forestry Development Committee planting targets are met, by the end of the century New Zealand will be able to harvest enough wood to meet not only its requirements for timber and pulp products, but also to supply most, if not all, of its energy needs. In view of the impending shortages of fossil liquid fuels, it is important that ways of converting the wood to liquid fuels be developed as soon as possible. One very promising conversion process is being investigated by the Physics and Engineering Laboratory. It is a two-stage process in which the wood is first broken down to a "synthesiser gas" by means of thermal gasification, and then methanol is synthesised from the gas.

Commercial plant is in operation overseas to produce purified synthesiser gas from coal and from organic wastes, but to date no commercial plant operates on wood. Synthesis of methanol from "synthesiser gas" is already well established. There are many other potential uses for fuel gases derived from wood. Two notable examples are as fuels for diesel engines and furnaces. Devices for producing wood gas mixture suitable for these purposes are available in several countries, and another part of the PEL work is the introduction of this technology to New Zealand.

Type approval testing: In our present difficult economic situation manufacturers are being encouraged to move into high-technology areas such as communications, electronics, and specialised electrical installations. Because many of these products are used in demanding applications, and those where safety of life is involved, they will normally require a certificate of compliance with a recognised performance specification of local or overseas origin. Because of its expertise in the field of measurement and the extensive test facilities which have been established, particularly in the field of environmental testing, this laboratory is being called on to perform an increasing number of type approval tests. In the electrical field this covers aviation and communications equipment and high voltage electrical gear. There is a corresponding effort being called for in the mechanical testing field. Many of the tests are very stringent and stretch our resources. For example, aviation communications equipment must be able to perform over the temperature range of −40 to +75° C and some New Zealand-made communications equipment can do just that. Tests for marine communication equipment include subjecting the equipment to an intermittent salt spray for the period of a month, and in every case our high-power vibration exciter is called into use. New Zealand-made high voltage cable has taxed our capacity to measure its loss angle at 33 000 volts. In one case we have made comparative tests between the New Zealand and imported items and this has been largely instrumental in halting the flow of imported equipment. This is an unromantic, little publicised, and extremely demanding facet of the work of the laboratory, but one which can have a major impact on the economy of the country.

PLANT DISEASES DIVISION

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TELEGRAMS: PLANTLAB Auckland TELEPHONE: 893 660 Auckland
TELEX: NZ 21623

DIRECTOR: E. G. Bollard, PhD *Cantab*, FRSNZ, FNZIC
Bacteriology and Virology: D. W. Dye, PhD *Edin*
Mycology and Plant Protection: P. J. Brook, PhD
Nematology (jointly with Entomology Division): F. H. Wood, PhD
Pomology and Processing: G. Strachan, Bs *Oregon S*
Basic Science: R. L. Bieleski, PhD *Sydney*, FRSNZ
Scientific Liaison: G. C. Weston, MA *Oxon*

RESEARCH·ORCHARDS

Kumeu (Auckland); Te Puke (Bay of Plenty); Havelock North (Hawke's Bay); Appleby (Nelson); Earnscleugh (Central Otago); Totokoitu, Rarotonga (Cook Islands)

VEGETABLE RESEARCH AREA

Pukekohe (South Auckland)

SUBSTATIONS

PALMERSTON NORTH: c/- Grasslands Division. G. C. M. Latch, PhD *Wisc*
LINCOLN: c/- Crop Research Division. B. T. Hawthorne, PhD

STAFF: 57 scientists, 64 science technicians, and 36 supporting staff.

The Division carries out research on the nature and control of fungous, bacterial, virus, nematode, and physiological diseases of all economic crops; the taxonomy of fungi and bacteria; plant physiology, especially on mineral nutrition and growth substances; the production, storage, and processing of vegetables and of pip, stone, citrus, and subtropical fruits; and disease and horticultural problems in the South Pacific region.

Current projects

Bacteriology and virology: control of bacterial diseases in orchard trees, field crops, vegetables, and horticultural plants; taxonomy of plant bacteria; use of bacteria in agriculture, nitrogen fixation by *Rhizobium* and *Azotobacter*, use of bacteria antagonistic to pathogens; national reference culture collection of plant bacteria and fungi; identification and control of viruses of economically important plants; studies of virus transmission methods and identification of insect vectors; production and maintenance of virus-free clones of deciduous fruits and grapevines.

Mycology and plant protection: studies of fungi causing damping off and root rots of horticultural and field crops, pasture plants, and trees; fungi causing airborne diseases of pasture plants, maize, berry fruits, grapevines, tree fruits, and a variety of vegetable and arable farm crops; diseases of turf; chemical and other means of controlling fungous diseases; seed pathology; climate in relation to epidemics; pasture fungi in relation to animal disorders; taxonomy of New Zealand fungi, and maintenance of a herbarium; relations of imperfect to perfect stages of fungi; records of plant pathogens in New Zealand.

Nematology: joint programme with Entomology Division (*q.v.*).

Pomology and processing: evaluation of varieties, rootstocks and cultural practices for temperate and subtropical fruits; testing of possible new fruit crops; crop forecasting; prevention of frost injury; chemical regulation of plant growth; post-harvest physiology, and control of storage disorders; controlled-atmosphere storage; chemical composition of fruits and vegetables; preservation of fruits and vegetables by canning, freezing, dehydration and chemical methods; development and improvement of food and juice products.

Basic science: regulation of plant metabolism; mineral nutrition of plants, particularly nitrogen, phosphorus, and calcium; assessment of nutrient status of plants; transport of solutes in higher plants and in fungi, including mycorrhizas; physiology of fungi and mycorrhizas; mycorrhizas in nutrition and disease of horticultural, ornamental and orchard crops; chemistry and physiology of bacterial and fungal toxins; identification, estimation and synthesis of biologically active compounds; application of mass spectrometry to the study of biologically active compounds; sterile culture of plant tissues; scanning and transmission electron microscopy of higher plants, fungi, bacteria, insects, and their cells; development of methods for electron microscope studies.

Activities in the South Pacific: assistance with the UN Development Programme/FAO Survey of Agricultural Pests and Diseases in the South Pacific region; development and curation of reference collections of fungal herbarium material and cultures of bacteria and fungi from South Pacific crop plants; taxonomy; disease records. Maintenance and development of the Totokoitu Research Station, on Rarotonga; problems of citrus and banana production, of subsistence crops, and other fruit crops.

PLANT PHYSIOLOGY DIVISION

Palmerston North
POSTAL ADDRESS: Private Bag, Palmerston North
TELEGRAMS: PLANTPHYS Palmerston North
TELEPHONE: 68 019 Palmerston North
TELEX: NZ 31285

DIRECTOR: J. P. Kerr, MAgrSc(Hons), PhD
Climate Laboratory
Climate Room Service: I. J. Warrington, MHortSc(Hons)
Technical Systems: R. W. Robotham
Forage and Crop Development: A. O. Taylor, BSc(Hons), PhD
Plant Biochemistry: C. R. Slack, BSc, PhD
Crop Physiology: H. G. McPherson, MAgrSc(Hons), PhD
Tissue Culture and Genetic Engineering: W. D. Sutton, BSc(Hons), PhD
Agricultural Physics: K. G. McNaughton, BSc(Hons), PhD

STAFF: 28 scientists, 24 science technicians, and 7 supporting staff.

Plant Physiology Division is concerned with the physiology of adaptation of plants to the New Zealand climate. Research is undertaken on aspects of photosynthesis, lipid biosynthesis, temperature and water stress physiology, genetic engineering, and evapotranspiration. Current interests include the development of conserved forage crops for animal production systems and the application of tissue culture techniques.

Core disciplines are crop and whole plant physiology, biochemistry, agricultural physics, genetic engineering, and agronomy.

Climate Laboratory

The Division is responsible for running the laboratory as a national research facility available to scientists in all New Zealand research institutions. The laboratory consists of 24 controlled-environment rooms in which temperature, humidity, daylength, light intensity, and carbon dioxide levels are controlled. Trained staff are available to supervise experiments and maintain the Laboratory.

Current projects include: response of *Pinus radiata* seedlings and rooted cuttings to temperature and photoperiod; influence of temperature on bud development and vegetative growth of kiwifruit; seasonal response of *Pinus radiata* and several *Eucalyptus* spp. selections to frosting treatments; response of several pasture grass species including ryegrass to moisture stress and temperature; the mobilization of sulphur from a range of New Zealand soils; leaf growth and development in maize in response to temperature; the influence of temperature and humidity on seedling germination and early growth in direct-drilled soil blocks; the screening of maize cultivars for low temperature tolerance.

Current projects

Forage and crop development: evaluation of conserved feed systems based on forage crops; field and laboratory evaluation of the cool season legumes; field evaluation of summer grass introductions in Northland in pure and mixed swards; cool tolerance in maize genotypes; rust resistance in forage oats; field wilting of cool season forages for silage.

Plant biochemistry: biosynthesis of polyunsaturated fatty acids in plants; basic studies in photorespiration; studies of seed development, oil composition and biosynthesis in safflower hybrids; influence of pretreatment conditions on biochemical analyses of plant material; CO_2 fixation of lupin root nodules.

Tissue culture and genetic engineering: clonal propagation of virus-free ornamental plants after thermotherapy; rapid micropropagation of poplar species and other soil conservation trees; tissue culture propagation of ornamental plants; introduction of nitrogen fixing genes into fungi; metabolism of detached lupin root nodules in culture.

Crop physiology: effect of water stress on leaf growth in pasture species including Nui, Ruanui and Prairie grass; stomatal behaviour in two clones of *Pinus radiata*; cell division and expansion in the growth of grass leaves; development of methods for measuring plant response to water stress.

Agricultural physics: microclimate modification using a mobile wind barrier; studies of the growth and nitrogen balance of a maize–winter oats rotation; analysis of the energy inputs into farming; physics of field wilting of forage crops; modelling water use by pastures and crops.

RIWAKA RESEARCH STATION

Old Mill Road, Riwaka
POSTAL ADDRESS: R.D. 3, Motueka
TELEGRAMS: RIWAKA RESEARCH Motueka TELEPHONE: Motueka 1735 + 501

DIRECTOR: A. A. Frost, BSc(Hort)
New Crops: P. E. Smale, MSc
Tobacco: R. W. James, BSc

STAFF: 5 scientists, 14 technicians, and 6 supporting staff.

This station is being established to provide a research facility for intensive crops of the Nelson-Blenheim districts. In addition to tobacco and hop research, formerly carried out by separate specialist DSIR stations, a new crops section is also being developed to investigate a wide range of annual and perennial crops of potential importance for the district.

New crops

Although the Province has a very large area of land suitable for the production of high value intensive crops, and a very favourable climate, its full potential has never been explored. This is largely due to the dominance of the tobacco crop in areas of suitable sites and soils, together with a heavy concentration of pip fruit on less fertile and more hilly areas. Lack of confidence in the future of tobacco, a reduction in hops acreage, and a pronounced trend from pastoral to intensive arable land usage, have generated a demand for investigation into the suitability of a wide range of crops. To meet this demand, trials of kiwifruit, grapes and a range of berryfruits were planted in the spring of 1978. Smaller areas of apricots, feijoas, persimmons, and figs have also been planted, and preparations is in progress for blueberry trials. A comprehensive range of annual crops is under investigation, including garlic, melons, tomatoes and early potatoes. Plant breeding and agronomic work on *Solanum aviculare* is now in its second season. Hop trials have been established, and all hop research will be transferred to the new station by the winter of 1979.

Tobacco—projects

Plant breeding: Breeding and selection for resistance to verticillium wilt, black root rot, blue mould, and tobacco mosaic virus; improvement of leaf quality characteristics including physical and chemical attributes; plant introduction and evaluation; regional testing programme of introduced and bred varieties; production of nucleus seed stocks; treatment of all commercial seed.

Agronomy: Effects of cultural and management practices on leaf quality, yield, chemical and physical properties; chemical control of sucker growth, rate of ripening, and carbohydrate assimilation; air-cured tobacco types; control of broomrape (*Orobanche minor*), and control of aphis (*Mysus persicae*).

Chemistry: Investigation of leaf; soil nutrient relationships; basic chemical and physical characteristics of New Zealand leaf.

Tobacco—activities

The tobacco crop grown in New Zealand is mainly flue-cured and the research effort is therefore concentrated on this variety of *Nicotiana tabacum.* Verticillium wilt is only known to infect tobacco in New Zealand. The station started seeking sources of resistance within the *Nicotiana* genus in 1948 and released the resistant flue-cured tobacco cultivar, Waimea, in 1967 and Kuaka 427 in 1973. A later selection Kuaka 860 with improved characteristics was released in 1977.

Economic improvements in the management of the crop have resulted from research into planting on ridges, the use of fatty alcohols to control axillary bud growth, plant spacing and maturity of leaf at harvest, herbicides for weed control, and field fumigation with metham sodium for broomrape *(Orobanche minor)* control.

Liaison with all sections of the industry is maintained through the Tobacco Research Advisory Committee.

The Tobacco Board supports the activities of the station by contributing 0.65 percent of the total value of the crop sold each season to the Consolidated Fund.

SCIENCE INFORMATION DIVISION

Cubewell House, 16–17 Kent Terrace, Wellington
POSTAL ADDRESS: P.O. Box 9741, Wellington
TELEGRAMS: SIDSIR Wellington TELEPHONE: 858 939 Wellington

SUPERINTENDENT: J. G. Gregory, MA *Oxon*, MIInfSc, MAIE
Supervising Editor: Q. W. Ruscoe, BSc (Hons), PhD *Exon*
N.Z. Journal of Agricultural Research: M. J. Baker BScAgri (Hons)
N.Z. Journal of Botany: Q. W. Ruscoe, BSc (Hons), PhD *Exon*
N.Z. Journal of Experimental Agriculture: C. Balog, BSc (Hons), PhD *Well.*
N.Z. Journal of Geology and Geophysics: R. Lynch, BSc, MSc (Hons) *Waikato*
N.Z. Journal of Marine and Freshwater Research: M. F. Beardsell, BSc (Hons), PhD *Massey*
N.Z. Journal of Science: N. Hawcroft, BA (Hons), DPhil *Oxon*
N.Z. Journal of Zoology: C. T. Duval, BSc
Supervising Photographer: J. J. Whalan
Chief Cartographer: D. D. McCormack
Chief Librarian: P. Szentirmay, AbsTheol, ANZLA

STAFF: 13 scientists and 54 supporting staff.

Science Information Division provides editorial, cartographic, library, photographic, and information assistance for all DSIR divisions and sections. It handles the printing, distribution and sales of publications, as well as publicising the work of DSIR.

Current projects

Cheaper methods of publication; computer editorial centres and interfacing with the Government Printer's computer printing; alternatives to normal publication, e.g., microfiche; computerised retrieval of bibliographic information.

Activities

Editorial section: Research by New Zealand scientists or by visiting scientists on topics of direct importance to New Zealand is published in the seven journals listed above.

Specialised bulletins, principally on geology, soils, and oceanography, are produced, and a limited number of books of more general interest are issued. The section also handles industrial advisory leaflets and publicity handbooks.

Central Library: Central Library contains a comprehensive selection of bibliographies, abstracts publications, and indexes, and provides a service for editors and authors. It also handles the purchasing of books and periodicals for the whole Department, keeps a Union Catalogue of DSIR holdings, and co-operates in an extensive interloan system.

Cartographic section: Maps dealing with geology, geophysics, oceanography, lakes, and soils are published by DSIR, and the cartographic section prepares drawings and overlays for printing. All classes of draughting, including the preparation of line drawings and diagrams to illustrate scientific papers, but excluding mechanical design drawing, are provided.

Photographic section: General, technical, and experimental photography is done for Head Office and the Wellington branches. The section provides a cine film unit for the Department and keeps a small collection of scientific and technical cine films.

Information section: Information complementary to the formal scientific publications is disseminated through the daily and technical press and other news and information media.

SOIL BUREAU

Eastern Hutt Road, Taita
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TELEGRAMS: SOBUR, Taita
TELEPHONE: 673 119 Wellington

DIRECTOR: R. B. Miller, BA, MSc, Agr L *Sweden*,FNZIC, FNZIAS
Chief Pedologist: M. L. Leamy, DSc *Well*
Soil Correlation: J. D. Cowie, MSc
Chemistry: W. B. Healy, MSc, PhD *Rutgers*, FNZIC, FNZIAS
Analysis: L. C. Blakemore
Agronomy: J. P. Widdowson, MAgrSci, PhD *Iowa*
Biochemistry: D. J. Ross, MSc, PhD *Lond*, DipBact. *Lond*, FNZIC
Biology: G. W. Yeates, BSc(Hons), PhD *Cantuar*
Physical Chemistry: N. Wells, BSc Sp *Lond*
Engineering: R. D. Northey, MSc, PhD *Lond*, DIC
Physics: M. W. Gradwell, BSc
Scientific Administration: R. J. Furkert, MSc, PhD *Well.*, FNZIC

DISTRICT OFFICES

AUCKLAND: Soil Survey, c/- Plant Diseases Division, Private Bag, J. E. Cox, MA *Cantab*
HAMILTON: Soil Survey, P.O. Box 1193, G. E. Orbell, MSc
ROTORUA: Soil Survey, c/- Forest Research Institute, Private Bag, W. C. Rijkse, Ing *Wageningen*
HAVELOCK NORTH: Soil Survey, DSIR, Goddards Lane, E. Griffiths, BSc(Hons) *Wales*
PALMERSTON NORTH: Soil Survey, c/- Grasslands Division, DSIR, R. H. Wilde, BSc(Hons)
WELLINGTON: Soil Bureau, Private Bag, Lower Hutt, J. D. G. Milne, MSc, PhD *Well*
NELSON: Soil Survey, DSIR, Private Bag. I. B. Campbell, MSc
LINCOLN: Soil Survey, c/- Crop Research Division, Private Bag, Christchurch. T. H. Webb, MAgSc
DUNEDIN: Soil Survey, P.O. Box 5133. F. G. Beecroft, BSc, DipNatRes
GORE: Soil Survey, c/- Grasslands Division, Private Bag. J. G. Bruce, MSc

STAFF: 65 scientists, 30 science technicians, and 18 supporting staff.

The Bureau studies the soils of New Zealand, some Pacific Islands, and the Antarctic to provide fundamental data for land use and soil engineering. The studies include mapping and classification of soils according to their morphology and genesis; characterisation of each soil and its physical, chemical, and biological properties; gauging of each soil's potential capacity to change under changing conditions; communication of these findings and their implications to others working on related problems; interpretation of findings in national and regional land use planning.

Projects

Soil resources: appraisal of soils for regional development, King Country; appraisal of soils for forestry development, Westland and Southland; soil surveys of counties, catchments and basins, urban areas, and other areas of special importance such as areas in the Clutha Valley likely to be affected by power development plans; determination of the soil resources of the Pacific Islands—Cook Islands, Tonga, Fiji; techniques and application of detailed soil surveys; revision of New

Zealand genetic soil classification; appraisal of Soil Taxonomy for New Zealand conditions; participation in international working parties on the taxonomy of tropical soils; evaluation of remote sensing, and grid sampling techniques in soil surveying; correlation of crop productivity data with soil units; classification of land for irrigation, forestry and food production; soil/forest productivity studies; evaluation of soils for different kinds of urban use; soil resource information—interpretation and application to indicative planning; nature of volcanic ash showers; loess as a soil parent material; studies to elucidate properties and processes in wet terrace soils on the West Coast of the South Island; studies on soil drainability on the Heretaunga Plains; detailed soil surveys of arable land; detailed studies of soils susceptible to accelerated erosion under forest use and under urban use.

Life sciences: effects of topsoil mining; fertility of soils from Cook Islands and Tonga; field trials (maize and citrus) in Cook Islands and Tonga; chemical properties of soil particle size fractions; Pauatahanui environmental investigation; effect of grass species on sulphur availability; population dynamics of pasture nematodes; effects of management on nematode populations in pastures; nematodes from New Zealand, Chatham Islands, Campbell Island soils; seasonal activity of arthropods in beech forest litter; beech forest studies on litter fauna, microflora, and comminution of organic matter by the detritus feeding beetle *Holotrochus;* taxonomy of *Holotrochus;* distribution of actinomycetes, particularly *Nocardia* and other soil bacteria and protozoa in the New Zealand region; Massey effluent trial; C isotope measurement of organic matter turnover; use of isotopic methods to study cycling of sulphur; investigation of relationships between soil organic chemistry and environmental parameters in New Zealand soils; humic and non-humic substances, including carbohydrates, polyphenols, and organic phosphorus compounds in New Zealand soils; metabolism of soil organic matter; range of studies on a climosequence of soils in tussock grassland including biomass, activities of a number of enzymes of soil and plant fractions, respiratory activity, and nitrogen mineralisation; chemistry and enzymology of litter decomposition; cellulose decomposition; availability of nitrogen for plant growth in yellow-grey earths in tussock grasslands; influence of temperature on biochemical processes in soils; soil sulphatase activity and the supply of organic S for plant growth; phosphatase and availability of soil organic P fractions for microbial growth.

Chemistry and data centre: analytical support for fertility trials in Cook Islands and Tonga; element analysis of soils and plants as an index of soil fertility; use of laboratory data in soil taxonomy; reserves and availability of soil potassium; total sulphur and adsorbed sulphate-sulphur in New Zealand soils; surface movements of plant nutrients on pasture slopes during rain storms; acid sulphate soils; chemistry of gley podzols; assessment of soil and site suitability for exotic forestry programmes; development of analytical methods; element distribution in deep loess profiles; New Zealand soil data base, computer based soil classification file; data storage, collation and correlation; chemical studies of pan formation; use of chemical parameters in studying pedological processes, phosphate adsorption and desorption on model soils; phosphate reactions in New Zealand soils; chemical studies of estuarine sediments; use of phosphorus budgets in lake management.

Physics and physical chemistry: moisture and temperature regimes of New Zealand and Cook Islands soils; storage and movement of water in soils of the proposed Ngatarawa irrigation scheme; aggregate stability of New Zealand soils under cropping; physical properties of pumice soils; unsaturated hydraulic conductivities and pore size distributions of New Zealand soils; soil physical properties in relation to catchment hydrology; soil engineering problems associated with Mangaweka deviation of North Island Main Trunk Railway; gamma ray attenuation determination of continuous density profile of soil cores; urban development engineering soil surveys; study of runway failures at Wellington Airport; underground corrosion of steel, cement products, ceramic field tiles, rubbers and plastics; stresses on buried pipelines; stem-flow and throughfall of rainwater on vegetation; lysimeter percolates from soil horizons; geobiochemistry of rocks, soils and plants; mineralogy of Tongan and Cook Island soils; reaction of fluoride ions with soils; element distribution in soil profiles; weathering processes in Antarctic soils; clay-organic matter interactions; beneficial action of sewage sludge on plants; geochemistry of iron and manganese in soils; study of iron in soils by Mössbauer spectroscopy; element and mineral distribution in aquatic communities; reactions of model organic compounds with topsoils; nature and origins of hydrous micas in soils.

WHEAT RESEARCH INSTITUTE

197 Hereford Street, Christchurch
POSTAL ADDRESS: P.O. Box 1489, Christchurch
TELEGRAMS: WHEAT RESEARCH INSTITUTE Christchurch
TELEPHONE: 791 548 Christchurch

DIRECTOR: R. W. Cawley, MSc, FNZIC
Basic Research: P. Meredith MSc, PhD *Birm*
Baking Technology: T. A. Mitchell, MSc

STAFF: 6 scientists, 7 science technicians, and 2 supporting staff.

The Institute does research and other scientific work for the wheat growing, flour milling, and baking industries.

Research is concentrated on a few chosen subjects, but information and advice are available on many aspects of cereal technology; mechanical handling of grain and flour; storage; drying; entomology and mycology; flourmilling; grinding; sieving; particle-size analysis; bread, cake and biscuit making; pasting and thickening; and nutritional aspects of cereals as human food and animal feed.

Flourmillers make extensive use of the Institute's test milling and baking services to help maintain uniform quality. Flour samples from all mills are regularly tested for the New Zealand Wheat Board.

Breeders' material is tested for milling and baking quality. Finance is derived from a levy on the flourmilling and baking industries and from a Government grant.

Current programme

Basic research—the developing cereal grain

Grains have been harvested every few days, from time of emergence of the flowering ear to ripeness and beyond, in studies of the anatomical and chemical changes of grain development. The programme, now in its tenth season, has included several varieties of European and Australian wheats as well as local varieties of wheat, oats, barley, ryecorn, and triticale.

Many aspects of grain growth are being studied, including simple measurements of weight gain, studies of starch granule development, the enzymes involved in starch synthesis and, in collaboration with workers in Canterbury University, light and electron microscopy studies of grain structure and C-13 nuclear magnetic resonance studies of the sugars of developing grains.

Payment for quality

A study of quality factors is being made, with the object of developing suitable objective tests which could be used as a basis for payment for wheat, thus providing a positive incentive for the production of better quality wheat.

Baking technology

The Institute has made an intensive study of the "mechanical dough development" process and its application under New Zealand conditions. It is now used to make about 90% of the bread in New Zealand, and study of the process is continuing.

CAWTHRON INSTITUTE

98 Halifax St, Nelson
POSTAL ADDRESS: P.O. Box 175, Nelson. TELEPHONE: 82 319 Nelson

DIRECTOR: R. H. Thornton, MAgrSc, PhD
Research Section: R. H. Thornton, MAgrSc, PhD
Cawthron Technical Group:
Chemical and Biological Services: A. Cooke, BSc, LRIC, MNZIC
Environmental and Feasibility Services: J. Bamford, BSc(For), BSc, PhD

STAFF: 13 scientists, 15 science technicians, 6 supporting staff.

The Institute's research programme is directed toward the microbiological degradation of natural and man-made organic materials. Knowledge and understanding of the ways in which microbes degrade and transform organic materials is applicable to study of water and soil quality, nutrient cycling, waste utilisation and treatment, and microbial fermentations.

The Cawthron Technical Group provides a confidential fully integrated consulting service, where one or more specialist skills are required, for industry, agriculture, local and central Government and ad hoc authorities.

Research Section: Current projects

Water quality: survey of relative trophic status by the heterorophic potential technique, of 26 high country lakes, including the Waitaki Power scheme storage lakes, and the Waikato, Maitai and Wakapuaka rivers; relationships between microbial activity and biomass estimations in lakes; bacterial degradation of algae and release of phosphate.

Biological, chemical, and physical properties of intertidal sediments; distribution and occurrence of photosynthetic bacteria in intertidal sediments of Delaware Inlet; transferable antibiotic resistance in coliform bacteria in natural and polluted, fresh and marine waters; "gelbstoff"—yellow colouring matter in north Westland lakes.

Waste utilisation: biochemistry of the degradation of *Pinus radiata* bark tannins by the fungus *Penicillium adametzi;* chemical and antimicrobial properties of tannin preparations; fermentation of wood-hydrolysis sugars to ethanol, and anaerobic fermentation of residues to methane; development of linked continuous fermentation process for ethanol and methane production as energy sources; biochemistry of methane formation by bacteria with special attention to acetate as a substrate; detection of plasmid-controlled microbial processes; incidence of transferable antibiotic resistance in coliform bacteria; degradation of cellulose by *Humicola* sp.; production and properties of bacterial polysaccharides.

Cawthron Technical Group

Chemical and biological services

Forestry: quality control of export wood chips; testing of pulp mill effluents; timber treatment testing.

Agriculture and horticulture: chemical and bacteriological testing of milk and dairy products, soil and plant and fertiliser analyses for pastoral agriculture, tobacco growers and Turf Culture Institute; mite-counting for orchardists; analyses for pesticide residues.

Fishing: process development; heavy metal analyses; bacteriological testing; effluent treatment and disposal.

Manufacturing: quality control of processes and products in food, wine and fruit processing industries; analyses of pesticide formulations and organic residue testing; product testing for Consumers Institute; hop resin analyses; antibiotic and vitamin determinations; biocide assays; effluent disposal; miscellaneous process and product development; bacteriological testing.

Local and ad hoc Authorities: water testing and pollution monitoring; miscellaneous investigations.

Environmental and feasibility services

Confidential advice on the environmental acceptability of projects and the necessary approvals, study and documentation required; preparation of environmental assessments and impact reports; feasibility studies and surveys on proposals for land use and resource development.

BUILDING RESEARCH ASSOCIATION OF NEW ZEALAND (Inc.)

Moonshine Road, Judgeford (near Wellington)
POSTAL ADDRESS: Private Bag, Porirua
TELEGRAMS: BRANZ Wellington TELEPHONE: 338 012 Plimmerton

DIRECTOR: P. K. Foster, MSc(Hons), PhD, DIC, FNZIC
ASSISTANT DIRECTOR: I. C. Hope, BSc(Hons), FInstF
Appraisal, Structures, and Advisory: J. S. Baty, BSc, MIEE, CEng, ANZIM
Components: H. A. Trethowen, BE, MNZIE, MASHRAE, MIHVE
Fire: D. Bastings, BE, MNZIE
Materials: R. S. Whitney, BSc(Hons), PhD, MNZIC

REGIONAL ADVISORY OFFICES: Auckland, Wellington, Christchurch, Dunedin

STAFF: 24 scientists, 9 science technicians, 19 supporting staff.

The Association promotes and conducts research and development in the building industry and provides information and a technical advisory service which is freely available to the industry. The Association has facilities available for materials testing and tests within the areas of fire, acoustics, and heat and moisture. Testing Laboratory Registration Council (TELARC) registration has been secured for some of these tests and registration for others will be sought as appropriate. Test facilities are used for research projects and, in association with clients, for product development testing.

The formal examination of new products and systems and the issue of Appraisal Certificates is an increasingly important service. Each certificate is a source of soundly based independent opinion, yet leaves the responsibility for approval with the specifier or authority. Continuing activity in this field is leading the Association into contributing to new designs and developments and is stimulating research and testing in new directions.

The demand from industry for information continues with the advisory service continuing to help with technical problems, dissemination of knowledge, and presentation of formal lectures.

Publications include research reports, technical papers, building information bulletins, an Annual Report and BUILD newsletter.

The Association's research programme was disrupted for a short period with the move into new premises at Judgeford, but is now adequately housed in satisfactory laboratories, workshops, and offices.

Current projects

The Association has been heavily involved in the appraisal of solar water heaters; a signed Appraisal Agreement between the applicant and BRANZ being the main requirement for the issue of a provisional Ministry of Energy charter qualifying the product for an interest-free loan. Considerable efforts were directed to checking technical provisions of the new light timber frame building code (NZS3604).

In order to fully understand the new code the building industry will require considerable assistance. The Association has embarked on an extensive programme to provide speakers and explanatory literature.

BRANZ continues to maintain an interest in energy use in buildings and additional work has been done on thermal insulation of buildings particularly on specific thermal design and investigation of causes of moisture accumulation in buildings. However, a review of the subject showed a declining need for further research into thermal insulation and later research is likely to be into ventilation control and development of more energy-efficient windows.

The Fire Division is currently committed to a high level of testing for industry and this has curtailed the division's ability to progress with research. Some work has been possible on fire retardant coatings and on fire properties of New Zealand concretes.

A report has been published on the Association's investigation of the safety supervisor scheme.

Before the product was introduced onto the market, the Association co-ordinated investigations into the paintability of galvanised steel chromated by a new process. Exposure trials of roof paints continue and the cyclic stressing and weathering trials of sealants are now into their second year.

An updated directory of freezing works flooring materials has been published and testing of those materials submitted is nearing completion.

COAL RESEARCH ASSOCIATION OF NEW ZEALAND (Inc.)

Cnr Gracefield Road and Bell Road, Lower Hutt
POSTAL ADDRESS: P.O. Box 3041, Wellington
TELEGRAMS: COAL Wellington TELEPHONE: 662 289 Wellington

DIRECTOR: P. A. Toynbee, BSc, DIC, MIChemE, FInstF, MNZIE

COAL ADVISORY OFFICES: Auckland, Hamilton, Palmerston North, Christchurch, Dunedin.

STAFF: 7 scientists, 19 science technicians, and 3 supporting staff.

The Association's activities are directed to the promotion of existing and new coal markets and to the replacement of imported fuel oil with indigenous coal. These efforts are concentrated on improving the quality of coal delivered to the user, ensuring greater cleanliness, convenience and efficiency in the handling and use of coal, maintaining an analytical service for the coal industry, and providing a national advisory service to coal users.

Current projects

Coal analysis: analysis of core samples from drilling programmes, or geological and prospecting samples, and of samples of mine production and of industrial coal.

Fundamental studies: basic work directed to a better understanding of the properties of New Zealand coals, which in many ways differ from those found overseas. Study of ash constituents.

Appliance development: design of domestic, commercial, and industrial coal-burning appliances to suit New Zealand coals. This work is determined largely by existing gaps in the availability of coal-fired appliances; by the need for a clean environment; and by the need to use coal to the maximum advantage to the national economy and provide a fuel to reduce consumption of fuel oil and electricity.

Materials handling: development and installation of modern industrial methods of coal handling and storage, especially of enclosed transport systems from enclosed bunkers, for automatic and dust-free operation; design of bunkers; introduction of containers for coal transport.

Pulverised fuel: application of pulverised coal to the firing of industrial boilers and to industrial drying processes; design of burners, pulverisers, classifiers, grit arrestors.

Coal preparation: consideration of coal-preparation plant for use under New Zealand conditions; improved methods of up-grading slack coal; drying of coal.

Activities

The suddenly increased demands for coal, for power stations, industry and households, has brought an expanded activity in the exploration of coal measures. Drilling programmes have been mounted in several areas to determine the extent of the country's coal reserves, and the Association is responsible for the analyses of the core samples from this drilling.

Physical and chemical studies in the laboratory are directed to a better understanding of New Zealand's unusual sub-bituminous coals. A better appreciation of the extremely high reactivity of these coals has led to the design of more suitable appliances, but this phenomenon is not completely understood, and a laboratory investigation is being carried out to provide further information on this unusual property.

The realisation that New Zealand, in the future, has to depend to a much greater extent on her indigenous resources of energy, highlights the importance of the engineering work that has been carried out by Coal Research Association over the last ten years, and brings the right climate for implementing the findings of this research—the achievements in improving the convenience and cleanliness of all forms of coal firing, the development of coal-fired space heaters acceptable for use in clean air zones, the developments in pulverised-fuel firing, the improvements in storage and handling of coal within factories, are all facets of the progress that has been made and which is now being put into practical use.

NEW ZEALAND CONCRETE RESEARCH ASSOCIATION

13 Wall Place, Porirua.
POSTAL ADDRESS: P.O. Box 50156, Porirua.
TELEGRAMS: CONSEARCH Porirua TELEPHONE: 8379 Tawa

DIRECTOR: J. E. F. Field, BSc, MNZIE

STAFF: 4 scientists, 5 science technicians, 1 supporting staff

The Association is concerned with studying concrete as a material, i.e. the characteristics of its constituents and their influence on its properties and performance. Specific investigations in co-operation with cement user organisations have increased in number, indicating an increasing awareness on the part of the concrete industry of the value to it of research and development facilities.

Training and education activities have continued with courses and seminars being arranged at various times during the year.

Current projects

Concrete aggregates: the potential of new sources of material in concrete making in relation to the proved qualities of existing materials has been emphasised.

Concrete masonry: development of valid testing procedures for structural masonry; investigation of factors affecting masonry performance.

Lightweight concrete: use of pumice and scoria, a lightweight concrete aggregate. Ultra lightweight concrete manufacture with a proteinous resin as a foaming agent.

Fire resistance: A joint research programme with BRANZ into the fire resistance properties of various aggregates used in concrete.

Soil cement stabilisation: Investigations to obtain an indication of the behaviour of different soils to cement stabilisation.

Testing machine calibration: A calibration service to complement the load verifications services already offered to operators of concrete compression machines.

Plaster: investigations into the effectiveness of methods of plastering walls in squash courts.

Concrete admixtures: A continuous research into use of various admixtures for the production of shrinkage compensated, water reduced, and self-flowing concrete.

Interlocking concrete block paving: Development of a series of tests with the view to determine a relationship between materials and block strengths.

NEW ZEALAND DAIRY RESEARCH INSTITUTE

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R. C. Lawrence, BSc(Hons) *Lond*, PhD *Massey*, FNZIC
W. B. Sanderson, BAgrSci NZ, PhD *Wisc*, MNZIC

STAFF: 64 scientists, 66 science technicians, and 36 supporting staff.

*Seconded, January 1978, to New Zealand Dairy Board, Japan, as Technical Director Japan and East Asia.

The New Zealand Dairy Research Institute celebrated its Golden Jubilee in 1977 and is the largest and longest established of the 11 Research Associations supported jointly by Government, through the DSIR, and individual industries. The Institute is the research organisation which serves the manufacturing side of the New Zealand dairy industry. Its work is handled by 15 research sections, whose programmes cover applied and more basic matters related to the manufacture and composition of dairy products and includes a wide range of topics relating to new and traditional dairy products, new and improved methods of manufacture and new uses for milk and its constituents. The Institute also provides a comprehensive testing and advisory service to individual companies and plants on a chargeable basis.

As in recent years, much effort has been devoted to decreasing manufacturing costs through improved technology and mechanisation and through energy conservation within the industry. This work, coupled with a current emphasis on maximising the recovery of milk solids and minimising of waste and hence pollution, has led to a marked improvement in overall efficiency. This predominantly applied research is supported by longer-term investigations designed to increase the knowledge of the basic components of milk and the influence of processing conditions on the properties of dairy products, especially those which are constituents of a wide range of foods as diverse as sweetened condensed milk, baked goods, and salamis.

The Institute provides an extensive liaison and information service to the dairy industry. Its publications include the *New Zealand Journal of Dairy Science and Technology*, a comprehensive Annual Report, and proceedings of specialist conferences and symposia.

Some Activities of Special Interest

Cheese: Long-term investigations into the lactic streptococci which play a vital role in the manufacture of almost all varieties of cheese and into the virus-like bacteriophage which can destroy them, have led to the development of multiple strain cultures. These are much less susceptible to failure through bacteriophage attack and lead to cheese of consistently good flavour. Considerable progress has also been made with the development of deep-frozen concentrates of these multiple cultures for distribution to cheese plants in a ready-to-use form.

Recent work on non-Cheddar varieties of cheese has centred on Swiss-type cheese and Camembert. The latter variety has found a ready acceptance on the local market and the demand cannot be satisfied by the Institute's current production of about 1000 pieces per week.

Butter and milkfat: Market evaluation of a butter which spreads easily straight from the refrigerator is almost complete. The development of this product has also given rise to dairy products of significance in the bakery and confectionery trades and to butters being suited to the needs of tropical markets.

The distinctive yellow colour of New Zealand milkfat is a disadvantage when attempting to make products such as Fetta cheese, which traditionally is almost white. A low-cost technique for reducing the colour of milkfat has been developed which, unlike existing methods, does not have undesirable side effects such as the development of oxidative flavours.

Milk powders: Commercial adoption of Institute-developed methods for instantising of fat-containing powders is now well advanced. A programme directed to the elimination of human error through the computer control of evaporation and spray drying is also well advanced. This research has permitted closer than normal control over product specification and an extension of the period of the dairying season during which the more difficult specification products can be made.

Optimisation of yield and energy use: The dairy industry has a good reputation for efficient use of energy. This is, in considerable measure, a consequence of the attention the Institute has given over the past 25 years to the measurement of energy use and the provision of assistance with energy conservation measures, from waste heat recovery to the replacement of steam by hot water heating. Special effort is being directed to total energy schemes in which waste heat from on-site electricity generation is used for processing.

Attention to efficient use of energy has markedly reduced thermal pollution, while work on loss of product from the exhaust of spray driers has increased production and decreased pollution. Current emphasis on monitoring and minimising the effluent from dairy plants, combined with precision measurement of incoming milk and product made, is markedly improving product yield. This work on mass balances has been materially assisted by the setting-up of a mobile laboratory which can be moved from plant to plant.

NEW ZEALAND FERTILISER MANUFACTURERS' RESEARCH ASSOCIATION (Inc.)

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DIRECTOR: J. Rogers, MSc, PhD *Cantab*, FNZIC, MAIME, MAIMM
Chief Chemist: P. J. Gallaher, BSc, FNZIC
Agronomy: F. B. Muller, MS (RI)
Physical Chemistry: M. S. White, MSc, PhD *Tas*, MNZIC
Chemical Engineering: D. G. Butterworth, BEChem (Hons) *Q'land*
Librarian: Mrs R. A. Worthington, NZLA Cert.

STAFF: 11 scientists, 6 science technicians, and 4 support staff.

The primary function is to undertake research of importance to the economic operation and future planning of the fertiliser industry. About 70 percent of the research effort is devoted to fertiliser manufacture and 30 percent to fertiliser use. Progress reports are distributed to members quarterly. Services to members include specialist advisory and analytical services, particularly in the field of herbage analysis, a monthly newsletter, liaison with other research and technical bodies, and organisation of regular Research Symposia and Technical Conferences. A feature of the Associations' activities is the frequency of technical committee meetings, both fertiliser processing and fertiliser use, to keep abreast of work being done and of problems which arise in the industry.

Current projects

Fertiliser processing: Recent work has been notable for fuller testing of laboratory results and the design of laboratory experiments which can simulate works practice. This experience is being used in works trials of making superphosphate with rock blends containing Christmas Island 'B' phosphate calcined at 1150° C. These trials will provide information for the New Zealand and Australian Governments. Large capital sums will have to be committed by Government if New Zealand and Australia are to continue to draw supplies of phosphate from Christmas Island after about 1985 until early next century.

The Association is now playing a much greater role in meeting this challenge than it was able to do in 1965 when the first shipment to New Zealand of Christmas Island 'A' phosphate was made into superphosphate after blending with Nauru phosphate. As well as providing information on the chemical analysis, mineralogy, and behaviour in laboratory acidulations of this material, the processing conditions, physical and chemical properties of the product, and the gaseous and liquid effluents, are monitored in works and reported on now.

The fluoride electrode is a specific example of a new research tool, introduced at Otara in 1968, and now used within the industry as the standard method for fluoride determination in raw materials, product, and effluent samples. It is now being tested for process control to provide a continuous monitor of fluoride effluent.

The closer association with the staff of fertiliser companies resulting from this outgoing policy has increased the liveliness of discussion at technical meetings. Further progress is anticipated at the 17th Technical Conference planned for November 1979 as the programme provides for more discussion of industry's development as well as research at Otara.

Agronomy: The Association continues to monitor accessions of major plant nutrients in the rainfall at the Research Station, and also measures their movements through the local soil.

Glasshouse pot trials are evaluating calcined Christmas Island 'C' phosphate high in iron and aluminium (Calciphos) for direct application to the soil. Problem soils, particularly from the South Island, were brought to the glasshouse to study movement of nutrients through the soils, particularly phosphorus, sulphur, potassium and magnesium. Water-insoluble phosphatic fertilisers such as Calciphos, highly reactive apatites such as Chatham Rise phosphorite, and fused calcium-magnesium phosphates may have advantages over the water-soluble superphosphate under severe leaching conditions of poorly retentive soils.

Mixtures of Calciphos and superphosphate are also being evaluated on a variety of soils as a means of utilising the very large tonnage of this material which is not suitable for superphosphate manufacture.

NEW ZEALAND LEATHER AND SHOE RESEARCH ASSOCIATION (Inc.)

Corner of Dairy Farm and Poultry Farm Roads, Palmerston North.
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DIRECTOR: G. W. Vivian, MSc, PhD *Leeds*, MNZIC
DEPUTY DIRECTOR: A. Passman, BSc (Hons) *Leeds*, Dip NLC
Leather Technology: A. Passman, BSc (Hons) *Leeds*, Dip NLC
Footwear Technology: A.J. Harvey, BTech (Hons) (Ind Mgt), ANZIM
Effluent: I.G. Mason, BTech (Biotech), MSc *Newcastle*
Microscopy: R.H. Milnes, BTech (Hons), PhD *Reading*

STAFF: 6 scientists, 8 science technicians, and 4 supporting staff.

The Association is the central research organisation of the fellmongering, hide and skin curing, tanning and footwear manufacturing industries. It provides a number of services to members: it maintains an up to date library of relevant journals, periodicals and textbooks and disseminates information in overseas journals in regular reports; it determines chemical and physical properties of pelts, hides and skins, tannery processing liquors and chemicals, leathers and all types of materials and components used in footwear manufacture and it examines and reports on consumer footwear complaints. The annual technical conferences for each industry and the regular visits to members by LASRA staff to assist with current technical problems are effective communication services. The Association participates in industry training programmes; it runs a technical correspondence course for the Tanning Industry Training Board and a block course on fellmongering for the Meat Industry Training Board.

Current programme

Raw stock evaluation: An investigation into the microstructure of leathers and skins. Such effects as food regimes, methods of husbandry, ectoparasitic influences, and breed are being evaluated on raw stock and in the finished leather. Current investigations include hides of exotic beef breeds, the relation between farming conditions and the incidence of mycotic dermatitis on bobby calf skins, and the effect of lice on cattle hides.

Fellmongering and hide curing: "Propel", code name for processing pelts. A statistically planned experiment to investigate the effect on the pelt of temperature, composition and duration of liming and composition of the bate liquor, following normal as compared with "Quikpul" painting.

Influence of additives to paint. A testing rig has been constructed for the evaluation of auxiliary materials that increase the solubility of the hydrated lime thickener in depilatory paints thereby increasing their alkalinity.

Hide, skin, and pelt preservation; bactericides and fungicides. This continuing project is concerned with raw material preservation treatments and the assessment of new fungicides and bactericides as auxiliaries in preservation treatments.

Temporary preservation of hides and skins. The requirement is for green stock to keep sound for 7 days. A range of biocides and application methods are being assessed for treated hide stored at 20° C and 30° C. Cooling to 5° C and 10° C may provide effective temporary preservation.

Pallet packing of hides and pelts. An investigation into variations of pallet packing methods and into the causes for shipping company and tanner criticism of pallet packed pelts. A Standard Specification has been written: a demonstration for producers of high density packed pallets of pelts has been held.

Leather: Rapid wet-blue processing. The aim is to establish processing conditions for the production of wet-blue hides from fleshed green hides in 22 hours. The project is to include examination of recycling lime/sulphide unhairing liquors and of chrome tanning liquors. Recycling liquors is not practised in industry; benefits are savings in chemicals and effluent treatment costs.

Aqueous degreasing of woolskins. Woolskins are solvent degreased in the crust tanned condition. Pretanning systems that raise the shrinkage temperatures of pelt but do not discolour wool are being examined. Such a pretannage should permit removal of natural grease in an aqueous system with combinations of surfactants and solvents at elevated temperatures.

Woolskin washability and lustre. An examination of tanning methods that meet the Australian Wool Board Launderability test. The effect of washing on wool lustre is to be examined to find an ironing treatment which is substantive in terms of lustre and also makes the wool non-flammable.

Resins evaluation. A continuing project is the assessment of chemicals offered to the N.Z. tanning industry. Current work is the examination of leather finish binders. Useful techniques have been developed for categorising resin emulsions. Particle size range for each resin has been measured from electronmicrographs produced by DSIR.

Perspiration and its effect on leather. Since much of the damage to vegetable tanned leathers during wear is associated with oxidative reactions, particularly at perspiration-induced pHs, a factorial experiment has been designed to test the benefits of adding antioxidants during and after bark tanning. The project includes an evaluation of laboratory tests for perspiration resistance compared with wear trial results. This wear trial is to incorporate an assessment of the wear performance of various soling materials, so the new PFI soling abrasion machine can be calibrated.

Effluent: Design of sulphide oxidation plant. An investigation of the relationship between sulphide removal rate in liming liquors and oxygen transfer coefficient to tap water in the same apparatus. Laboratory data has been used to predict pilot scale performance and a study of scale-up criteria is being made. The aim is to produce a simple design method for catalytic oxidation plant.

Chromium removal from tannery effluent. Optimisation of lime and polyelectrolyte flocculation/precipitation of chrome tannins from tannery effluent. Development of a pilot scale treatment system incorporating sedimentation or flocculation and optimum flow balancing. This work is being carried out in conjunction with DSIR.

Footwear: Laces survey. A continuing project is the assessment of materials and components offered to the footwear manufacturing industry. Present work is a test survey of breaking load, abrasion resistance, fibre type and construction of currently available laces.

Shoe room treatments. A survey of materials and methods used in the shoe room before boxing leading to recommendations for acceptable practices.

N.Z. LOGGING INDUSTRY RESEARCH ASSOCIATION

Forest Research Institute, North Entrance, Sala Street, Rotorua
POSTAL ADDRESS: P.O. Box 147, Rotorua

DIRECTOR: J. J. K. Spiers, BSc, MF *Brit. Columbia*

STAFF: 4 scientists and 2 supporting staff.

The Association, incorporated in 1974, commenced operations in November 1975. LIRA was established to meet the need for industry-oriented applied research in logging; to promote, co-ordinate, supervise, and conduct research and development for the logging industry.

Current projects

Protective logging: The methods, costs and benefits of special-purpose logging to meet environmental constraints are being examined in a series of case studies at a variety of locations. The aim is to advise industry on the need for this type of operation, to assess costs, and to evaluate possible benefits. The development of methods for directional felling required for protection work is also under investigation.

Machinery evaluation: New equipment and developments are being studied and tested under field conditions with the co-operation of industry. The aim is to establish criteria for selection by assessing the potential and limitation of machines and the possible extent of their use. Assistance is given with development and modifications to meet the requirements of field conditions in New Zealand. Initial work has been completed on shears, feller-bunchers, and power saws. Current work is on delimbing, cable-hauling, and log-loading machinery.

Costing methods: Many small operators in the logging industry experience difficulty in understanding and calculating operating costs. Basic investigational work has been started and a series of Interfirm Comparisons were carried out to establish the cost structure in the industry and to monitor trends. Work has begun on producing a costing handbook guide for operators and studies are being made of the factors affecting production and costs.

Basic data collection: Basic national or regional data that would help advance planning and machinery development are lacking. A start has been made on co-ordinating a data collection system. Surveys in certain areas such as log transportation and cable hauling are being conducted, and basic measurement of such things as tree weight has been started.

Extension activities: Extension activities are considered most important for this widely dispersed rural industry. LIRA produces several series of short publications aimed at rapid dissemination of technical information covering work in progress, interim results, and summaries of final conclusions. In addition, detailed reports on completed projects are produced.

A major aspect of the extension activities is the setting up of forums for discussion on topical matters, through seminars and meetings with industry groups, etc. These are conducted in a variety of locations throughout the country and have covered such topics as chainsaws and safety, logging costing, interfirm comparisons, cable hauling, and delimbing.

Methods development: Improving the industry's understanding of the systems and the technology of tree harvesting is considered an important aspect of the Association's work. Development of new methods for cable hauling and controlled felling are currently being undertaken.

MEAT INDUSTRY RESEARCH INSTITUTE OF N.Z. (Inc.)

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Divisional Heads: P. M. Nottingham, MSc, PhD *Aberd*, MNZIC, FIFST
L. F. Frazerhurst, BE (Mech)
Secretary: J. van Harskamp, ACA

STAFF: 37 scientists, 51 science technicians, and 17 supporting staff.

The Institute undertakes research and development for the New Zealand meat export industry, encompassing almost every aspect of freezing works operation, and product transportation to markets. More than 100 projects are currently under way in the areas of meat science, meat and by-product processing, pollution control, engineering, and management.

Current projects

Meat processing: Accelerated conditioning using high-voltage electrical pulses to set carcasses rapidly in rigor mortis avoids cold-induced toughness. The process allows more rapid refrigeration of meat, and thus reduces the need for cooling floors for lamb and chillers for beef. Various systems devised by MIRINZ are now under test in the industry.

Other projects include hygienic slaughter; improvements to carcass freezer design; the interrelationship between packaging film properties and storage life of chilled meat; efficient carton sorting.

By-products: The rendering department of a freezing works, where inedible offal, boning room scraps, and condemned parts of carcasses are rendered down to tallow, oil and meals, is practically a self-contained unit. This has allowed very comprehensive studies of costs, technical performance, and labour utilization in individual departments, and the results show that large savings in time and money can be made by simple adjustments to traditional procedures.

Other projects include: development of viscera cutting machinery; new blood drying technology; mucosa collection, concentration, and preservation.

Engineering: New slaughter methods provide the possibility for works to produce high-quality blood products. A major cost in any blood processing system is ‘dewatering’ the dilute raw material, and MIRINZ has introduced to the industry the technique of ‘ultrafiltration’ which uses a membrane as a molecular sieve for concentration of proteinaceous solids in blood. Pilot-scale ultrafiltration units have reduced the cost of concentration by half, and a large-scale plant is now being developed.

Other projects include refrigeration surveys and energy audits at freezing works; computer control of beef chillers; the rationalisation of turbine meter circuitry.

Pollution: The activated sludge process, in which organic matter in effluent is used as a nutrient source for aerobic bacteria, has seldom been used to purify meat works wastes because of the high costs involved. However, changing the process to maximize bacterial growth results in conversion of organic solids to a protein-rich microbial product suitable for pig food. Much of the nitrogen and phosphorus in effluent is also removed in the process, and an acceptable level of purification is obtained. Techniques for handling the recovered solids are now being studied.

Other projects include development of analytical methods for effluent study; in-plant evaluation of waste water screens; fellmongery waste treatment; analysis of departmental wastes.

Meat science: The application of accelerated conditioning by electrical stimulation has opened the way for boning of beef to be carried out before chilling. However micro-organisms on hot-boned meat are protected from the cold shock and dehydration they normally experience in a chiller and consequently hot-boned meat could have a heavy bacterial load by the time it is frozen. A study of the growth rates of various important bacteria on hot-boned meat is aimed at determining the time/temperature parameters for processing which would avoid any downgrading of purity of the product.

Other projects include: studies into the collagen content of meat; control procedures for salmonella in boneless veal, beef and mutton; techniques for early post-mortem measurement of muscle pH.

NEW ZEALAND POTTERY AND CERAMICS RESEARCH ASSOCIATION (Inc.)

DSIR No. 2 Building, Gracefield Road, Lower Hutt
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TELEGRAMS: PACRA, Physical, Lower Hutt TELEPHONE: 666 919 Wellington

DIRECTOR: H. J. Percival, MSc(Hons), PhD *Well*, MNZIC
Ceramics Advisory Testing Service: Mrs Z. Demchenko, DipIngChem *Kharkov*, MNZIC

STAFF: 5 scientists, 5 technicians, and 2 supporting staff.

The Association engages in research work relevant to current interests of the New Zealand ceramics industry and provides a technical advice, information, and testing service for the industry. Research interests can be divided into two broad categories: investigations related to the improvement of the manufacturing processes, and investigations aimed at improving the use of the final product.

Current projects

Slip studies: The production of whitewares involves the preliminary processing of clays in fluid suspension ("slips"). Current work was undertaken to determine how best to manipulate the properties of production slips so that the plastic clay bodies pressed from them (by filtering under pressure) would be at an optimum condition for ease of subsequent processing into articles. It appears that for practically important changes in body properties to be introduced at the slip processing stage a substantial alteration to the exchangeable cation state must be induced. The practical means of achieving such an alteration and the consequences in terms of changes in body properties is the immediate aim of this project. In conjunction with the above a major effort is being put into the development of a method to evaluate clay plasticity from the results of mechanical testing. Future work will attempt to overcome the lack of a sensitive and reliable measurement of clay plasticity.

Masonry studies: A programme of dynamic load testing of brick veneer panels on timber frames is continuing. The aim is to demonstrate the seismic capacity of reinforced and unreinforced veneers. Different designs are being tested. In conjunction with the veneer testing, there will be studies of the test methods for brick-mortar bonding and of the effect of grout strength on reinforced masonry prisms.

Pipe studies: Changes in the methods of drying and firing of pipes are being examined, changes aimed at improving dimensional tolerances and increasing the pipe length without increasing the pipe weight. Thinner-walled pipes are necessary and therefore practical methods for giving the required increased strength to the pipe material are being investigated. Attempts to improve strength are being carried out by impregnating fired pipes with various polymers.

Fracture studies: A study of the effect of firing temperature on the fracture toughness of whiteware (tableware, sanitaryware, and porcelain insulators) clay bodies is continuing. The toughness characteristics will be compared with more familiar physical properties such as strength, porosity, etc. as well as the microstructure of the fired body. The effect of body formulation on fracture toughness is also being studied, in particular the effect of quartz particle size and distribution within the body. A start will be made in evaluating the application of Hertzian cracking (conical, surface cracks caused by hard contact with any point load) as a measure of the chipping resistance of ceramics related to in-service handling.

Refractories and special ceramics: Once the commissioning of a new refractories testing furnace is complete, investigations into the manufacture and use of ceramics resistant to high temperature will be initiated.

RESEARCH INSTITUTE OF TEXTILE SERVICES (Inc.)

DSIR No. 2 Building, Gracefield, Lower Hutt
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DIRECTOR: M. S. Kaiser, BSc, MIEE
CHIEF SCIENTIST: N. S. Whittall, MSc

STAFF: 4 scientific and 1 supporting staff.

This Institute is a central organisation providing a technical service to the laundry and drycleaning industries including hospital boards. In recent years it has also provided an expanding technical testing and advisory service to the textile and clothing industry.

The Institute also offers to members a work study and planning service aimed at ensuring efficient use of equipment and manpower. This facility is widely used in the hospital laundry field which is highly labour oriented.

Research work is mainly of an "ad hoc" nature and covers a wide range of problems occuring with the use of new fibres, fabrics and chemical textile finishes. The institute carries out considerable textile testing covering quality, flammability and make-up procedures. This aspect of the Institute's work is being increasingly used by the clothing industry for purposes of care labelling, and by linen-hire companies and hospital boards in the selection of textiles.

Current programme

The Institute is carrying out a long-term investigation into energy usage in the laundry and drycleaning industries. In the former there is a large wastage in the use of hot water (for washing), which is generally disposed of directly without heat reclamation. Extended laboratory and plant trials have been carried out into washing with blended detergents at temperatures as low as 35°C. Several plants are now using the low temperature process.

Work is being carried out to evaluate knitted nylon fabrics as alternatives to vinyl coated fabrics in the automotive field. Such work involves extended testing for resistance to a variety of factors, particularly extended abrasion and weathering.

A quality control monitoring programme using soiled test pieces had been re-introduced for dry cleaning and laundry members. This has resulted in a greater awareness of the need for better and consistent quality of work, and highlighted the importance of maintenance of equipment and staff training.

WOOL RESEARCH ORGANISATION OF NEW ZEALAND (Inc.)

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Measurement and Marketing: A. R. Edmunds, MSc, PhD *Leeds,* FNZEI
Engineering Services: A. Barker, CEng, MIMechE, MNZIE
Scientific Services: L. F. Story, BSc, PhD *London,* CChem, MRIC

STAFF: 29 scientific, and 55 supporting staff.

The Organisation undertakes research on all matters relating to the utilisation of New Zealand wool, including chemical and physical properties, marketing, scouring, processing and end use performance.

Current projects

Textile technology: Carpet manufacture and performance continue to be the main focus of activities. The tufting process is under continuous study to improve its efficiency in respect of wool yarn performance. The automatic WRONZ Carpet Wear Simulator-6S is being examined internationally to confirm its NZ-proven performance. WRONZ is assisting in the specification of contract carpets.

Instruments to measure the bulk of fibre masses and yarns have been developed and it is hoped to relate the measured fibre bulk to yarn bulk and the bulk of final products.

The relationships between other fibre characteristics and processing performance form the basis of another continuous study.

Knitwear from Romcross wools is being developed in conjunction with the International Wool Secretariat and the NZ Wool Board. This project will be extended to hand-knitting yarns.

The WRONZ attachment to the Repco self-twist spinning machine for making fancy slub yarns, and the aerodynamic machine for removing vegetable matter from wool have both reached the stage of industrial development, having excited considerable interest.

The production of novel felted yarns is being examined with the International Wool Secretariat.

Wet processing: The latest development of the WRONZ Comprehensive Scouring System is aimed towards operating it in a concentration destabilisation mode (as described by Australian workers) with a low flowdown of effluent. A complete effluent treatment package could include ultrafiltration and biological treatment, together with the use of decanter centrifuges to give a spadable sludge. The DSIR-designed plant for the solvent treatment of effluent has been commissioned and proving trials are in hand.

A plant for the recovery of heat from dyehouse effluent is being tested, and the use of "heat pipes" for recovering waste heat from a wooldryer is proving successful.

The principle of weighfeeding greasy wool into the scour has been proved to result in greater throughput and a more even moisture regain of the scoured wool. The method is being introduced into industry.

New methods of opening and dusting greasy and scoured wool are being investigated.

Different methods of setting yarns without loss of bulk and to enable carpets to be printed are being examined. A simple method of test is being developed for quality control in mills and to enable different methods and degrees of setting to be compared objectively.

Textile chemistry: Commercial applications of antistatic agents on carpets are now being made, particularly for contract carpeting for offices and computer rooms. The electrical resistance properties of wool are being examined.

The development of flameproof wool products for various end-uses, especially clothing, is continuing. New work on a study of toxic products of combustion is being initiated.

The basic surface properties of wool fibres are being determined with particular reference to the staining, soiling, and cleaning of carpets.

The study of the photodegradation of wool has progressed to the stage of seeking inhibitors of this phenomenon. Fabrics and fibres treated with various chemicals are being exposed to sunlight behind glass for appraisal.

The cross-dyeing of wool involving chlorination treatments is in the pilot-plant stage.

The fine structure of the cuticle scales of wool is being examined in relation to their biogenesis. The biological processes leading to a "break" in the growth of the fleece are being investigated with a view to their control.

Wool measurement and marketing: Sale by sample has now become established in New Zealand following demonstrations of the reliability of grab-sampling techniques. Appraisal trials are being held to evaluate woolbuyer assessments of grab samples and bulk wool.

A standard test method for measuring the colour of scoured wool has now been issued and is in use by test-houses.

The main study of slipe wool samples has been completed and the application of the results in the industry is in hand, leading to improved uniformity.

A device for detecting damp wool in bales has been developed and is being introduced in industry.

Scientific services: Testing and investigations for industry. Wool packs.

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